Warren County
Soil & Water
Conservation District

The information contained in this publication was obtained from the United States Department of Agriculture Natural Resources Conservation Service, the National Assiciation of Conservation Districts, and the Butler, Cuyahoga, and Lake Soil & Water Conservation Districts.

Revised 6/2022

POND CONSTRUCTION

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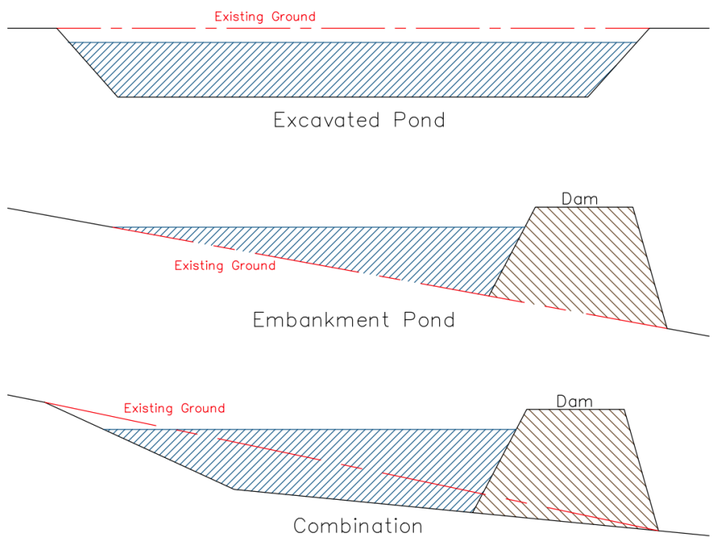
TYPES OF MANMADE PONDS

Excavated ponds, or dugout ponds, are mostly used where the existing ground is relatively flat. These ponds are normally built where the demand for water is small, and 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 Southwest Ohio. 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 water is impounded behind it. In general, the cost of constructing an embankment pond is less than an excavated pond of equal size due to the amount of soil moved.



THINGS TO CONSIDER BEFORE BUILDING

- Ohio has laws regarding the impounding of water. Many communities also have laws pertaining to ponds as well, so be sure that you and your engineer familiarized yourself with those regulations. Also check 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.
- To build a minimum-sized pond (¼ acre), we recommend a minimum of ½ acre (21,780 square feet) of stockpiling and turnaround area.
- We recommend that you teach your household and neighbors about water safety before developing a water area on your property.
- 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, you can swim in a fish pond but you can't expect fish to live in a swimming pool. Anyone who wants a crystal clear pond should strongly consider a swimming pool instead.

SEALING A POND

Excessive seepage in a pond is usually due to a poor pond site or improper construction techniques. Sites where inadequate soils are encountered during construction should be sealed by "clay blankets" which consist of well graded material containing at least 20 percent clay. Thickness of the blanket depends on the depth of the water to be impounded. 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 material in layers of 6 to 8 inches. Existing ponds that have excessive leaks may also need clay blankets.

Other materials to be used for sealing leaky ponds are bentonite, chemical additives, and waterproof linings. Bentonite is a fine textured colloidal clay. When saturated, it swells to many times its original volume. If mixed with well graded, coarse-grained material thoroughly compacted, then saturated, the material tends to fill pores and blanket the leaking areas. Some chemical treatments can be added to fine-grained clay soils to help in sealing seepage areas. This method can be quite complicated and laboratory analysis of the soil is essential to determine which type of chemical additive will be most effective and at what rate it should be applied. Many types of materials are being used as waterproof linings. Polyethylene, vinyl, and butyl-rubber membranes are just a few. They could virtually eliminate seepage if properly installed. A cover of earth may be needed for some linings to protect against punctures.

CONTACT & SUPPORT

For more information or help constructing your pond, contact Warren County Soil & Water Conservation District:

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CONSTRUCTION

Constructing the pond correctly is as important as the initial investigation itself. Careless construction can make an entirely safe and adequate design worthless and cause failure of the dam. Good pond 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.

Become familiar with the plans and specifications before construction begins. You will then be able to determine whether the work is going as planned when the engineer or technician is not there to inspect it. Be sure your pond is built according to the plans and specifications. Failures have occurred as the result of cutting corners in an attempt to save a little money.

The foundation of the dam is among the most important parts of the pond construction. If the dam's foundation is underlain by sands and gravels, 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 and side slopes no steeper than 1: 1. The trench is then backfilled and compacted in thin layers, 4 to 6 inches at a time, with good, clean clay material. The fill above the core trench should also be compacted in this way. If poor materials are encountered, during excavation of the pool area, some type of sealing may be needed.

When placing the principal (pipe) spillway through the fill, the material 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.

Complete fencing of areas on which embankment ponds are built is recommended if livestock are grazed or fed in adjacent fields. Fencing ensures clean drinking water and lessens erosion 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 that degradation of the banks is minimized.

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. 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.

The minimum surface area should be 1/4 acre (10,890 square feet) with 50 percent of the pond bottom six feet deep or 25 percent eight feet deep. 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 material. 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 as large as your planned pond and about eight to ten feet high.

ADDITIONAL THINGS TO CONSIDER IN SITE SELECTION

Erosion. 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 the upstream erosion have been installed.

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

Safety. Do not locate your pond where failure of the dam could cause loss of life and injury to persons, property, livestock, railroads, highways or interrupt 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.

Utilities. Be sure that no buried pipelines, cables or other utilities cross a proposed pond site. 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 landowner's responsibility. Avoid sites under power lines. Wires may cause a hazard to all uses of a pond. If live wires were to fall into the pond or if fishing poles, ropes, etc., were to contact the power lines, severe electrical shock could result.

WATERSHED AREA

The size of the watershed, the area that drains into a pond, is very important in selecting a pond site. Warren Co SWCD can provide mapping assistance with determining the watershed of a pond and interpreting a map. If the watershed is too large, you may have difficulty in preventing erosion at the pond site and an expensive overflow structure will be needed to bypass excess runoff during storms. If the watershed is too small, runoff may not be adequate to fill the pond and then keep it full. For pond health and sustainability, the design ratio between pond surface acre to drainage area acre should fall between 1:6 and 1:40. Sometimes drainage areas can be made larger or smaller using construction equipment; however, state laws do exist making the practice of diverting or changing natural drainage areas illegal.

SOILS

The engineering characteristics of the soils present play a major part in the construction of a pond, as suitability of a pond site depends on the ability of the soils in the pool area to hold water. Sites where the soils are fine-textured clays or silty clays that extend well below the proposed pond depth are most desirable. Sites where soils are coarse-textured sands and gravels are generally unsatisfactory. Outcroppings of rock or limestone usually are poor locations due to cracks and seeps which permit the water to escape. With an embankment pond, the soils must also be suitable for the core trench and dam.

Warren Co SWCD provides consultations and mapping services to help assess if the soils on your site are appropriate for a pond and can assist with using and interpreting maps from Web Soil Survey. The best way to determine if the soil is suitable for a successful pond would be to bore or dig test holes over the proposed site. When doing these test holes, make sure you dig deeper than the depth of the proposed pond. In most cases a backhoe should be used to dig test holes, this will allow you to see and determine the depths of different geologic materials you encounter and their suitability for pond construction. Warren Co SWCD technicians can provide assistance in interpreting test holes by appointment.

SPILLWAY REQUIREMENTS

For most ponds, both a principal and emergency spillway are needed. The principal spillway is a type of drop inlet or hooded inlet. 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 on the required discharge capacity. The size of the riser must be somewhat larger if the pipe is to flow full.

Hooded inlets consists of a pipe laid 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 on the required discharge. On both of these principal spillways, anti-seep collars should extend into the fill a minimum of 24 inches perpendicular to the pipe. These anti-seep 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. Any 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.

DESIGN

Designing a pond requires:

- computing the expected flow of water into the pond;
- setting elevations for earth spillways, pipe spillways and the top of dam;
- determining the dimensions of the dam and spillways and whether a permit is needed;
- establishing the degree of slope of the sides of the dam to be sure it is stable;
- calculating how much earth fill and other materials are required;
- preparing drawings;
- and prescribing construction methods and procedures.

Warren Co SWCD offers property and drainage technical assistance at no cost to Warren County residents and can assist with pond design. Alternatively, firms offer private services for pond design are also available for a fee.

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 give 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 probable seepage and evaporation losses. Ideally, ponds in this area 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 width should also increase. The recommended minimum top width with comparison to height is:

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 shall not be less than five horizontal to one vertical with neither slope steeper than 2: 1.