

Pond Facts #3

Fixing a Leaking Pond

Pond leaks are a very common pond management problem in Pennsylvania. Some leaks may be barely noticeable, while larger leaks can completely drain a pond. Unfortunately, fixing a leaking pond can be one of the most difficult problems associated with managing a pond. This article introduces the basic steps for determining if your pond is leaking and some tips for repairing leaks.



A leaking pond located in central Pennsylvania.

Causes of Pond Leaks

Pond leaks may develop from a number of causes. Probably the most common cause is inadequate construction of the pond bottom. Simply put, it is best to avoid a leaking pond by properly constructing the pond from the beginning. Areas of sand or gravel or fractures in bedrock that were not adequately covered with soil during construction may eventually leak.

Leaks may also occur around the pond banks or on the pond dam as a result of tree roots or muskrat holes. These leaks can be prevented by removing trees from the pond dam and by discouraging muskrats. In older ponds, leaks sometimes develop from outlet pipes that rust and leak below the water

surface.

Is Your Pond Really Leaking?

In some cases, a pond that appears to be losing water may not actually be leaking. All ponds lose water to both evaporation and seepage. Even a perfectly constructed pond with good soil may lose one inch of water per month to seepage. Losses due to evaporation can also be noticeable, especially during summer months. If a pond has a continuous supply of water from a spring or stream, this loss due to evaporation is usually not noticed. Ponds that rely only on surface runoff from surrounding land, however, can drop dramatically during dry weather. This is especially true for ponds that have less than 10 acres of drainage area per acre of pond surface. The maximum loss of water from a pond due to evaporation can be expected on breezy, warm summer days with low humidity. Under these conditions, a pond may lose over one-quarter of an inch of water in one day. Thus, during a two-week period without rain, a pond could lose nearly four inches of water simply due to evaporation.

Trees may also account for some loss of water in a pond. Water-loving trees, such as willows or maples, often grow along the banks of ponds. The roots of these trees may remove water directly from the pond as they grow. The loss of water from the pond will depend on the size, species, and number of trees, and the pond size, but they may account for several inches of lost pond water each month. The loss of pond water due to evaporation and trees rarely exceeds 12 inches, even during the driest month. Water-level reductions in excess of this amount would be indicative of a pond leak. If the pond level drops for an extended time due to drought, the exposed sides may dry and crack, causing pond leaks when the pond refills.



Finding a Pond Leak

The effort and expense necessary to fix a leaking pond is directly related to your ability to locate the source of the leak. Unfortunately, finding the location of a leak can be very difficult. Inspect the outlet pipe and drain pipe structures first to make sure that they are still intact. These structures often rust through in older ponds or ponds with corrosive water.

Leaks that occur on the pond banks or on the dam are sometimes easy to locate. Here, water leaving the pond may emerge on the outer surface of the pond, providing a clue to the location of the leak. Wet areas and growth of water-loving plants (like cattails) at the base of the pond dam or banks may be clues to the location of these pond leaks. Dyes may also be useful to locate these leaks. Sprinkling some solid, food-grade dye in the pond near a wet area along the bank may help determine if the pond is actually leaking at that location. Be careful to use small amounts of inert, food-grade dyes for this purpose.

Another characteristic of a pond with a leak along the bank is a rapid loss of water to a certain point, beyond which it then slows or stops losing water. In this case, the location of the leak can usually be found at or near the water surface somewhere around the perimeter of the pond. In the likely event that you cannot locate the general area of the leak, you will probably need to drain the pond and completely repair the entire pond bottom at significant expense.

Solutions for a Leaking Pond

The following paragraphs describe some of the options available to fix leaking ponds. In general, the methods described progress from easiest to more complex. The best method for sealing a leaking pond bottom will depend mostly on the type of soil that exists on the pond bottom. Of greatest importance is the mixture of large (sand or rock) and small (clay or silt) particles within the soil. A professional soil scientist or laboratory analysis may be needed to determine the type of particles in the soil before proceeding. In some cases, personnel from your local Natural Resources Conservation Service may be able to assist with soil characterization. These methods can be applied to specific areas (at lower costs) if the leaking area can be identified, or they can be applied to the entire pond bottom. In all cases, the affected area will need to be exposed and allowed to dry by draining the pond. While the pond is drained, all vegetation should be removed along with stumps and large rocks. Obvious voids should also be filled with soil.

Permits

In some cases, repairs to leaking ponds may require a permit or permit review. This is especially true for ponds that required an initial permit from the Department of Environmental Protection (DEP) Bureau of Dam Safety. Check with the DEP before proceeding with repairs on ponds that required construction permits

Make Up Water

In some cases, a simple solution to a leaking pond is to add water to the pond to make up for the lost water. This is usually only possible with very small leaks where a nearby spring or a groundwater well can be used to replace the lost water. Some pond owners use their home well to pump water to the pond during the night so it will not interfere with their normal use of water during the day. Such use of the home well for the pond should be done with great caution, especially during drought conditions. This additional pumping from your home well could dry up the well and cause the loss of water to your home. A professional hydrologist should be consulted to determine if your well could withstand the additional pumping during dry conditions. Also keep in mind that you may be required to register or obtain a permit for groundwater withdrawals to a pond if they exceed 10,000 gallons per day.

Compaction of Existing Material

If the existing bottom material contains a good mixture of coarse and fine particles, simple compaction may be adequate to slow or stop excessive seepage. The pond must first be drained and the affected area allowed to dry. The soil is then scarified with a rototiller or similar equipment to a depth of about 12 to 16 inches and then compacted with a roller. It is critical that the soil be compacted during optimum moisture conditions (i.e., not too dry or wet) to provide the best seal. The final compacted layer should be a minimum of 6 inches thick in the shallow areas of the pond and 12 inches thick where the pond is 10 feet deep.

Adding Clay

If the existing soil is too coarse (i.e., too much sand or gravel), clay can be added to provide a better seal. The added material should be at least 20 percent clay. Luckily, adequate clay is common throughout Pennsylvania and may even be available near the pond site. The clay should be spread in layers at least 6 inches deep but preferably one foot deep. Again, the depth of clay is related to the water depth. Deeper portions of the pond, where water depths exceed ten feet, should have at least 12 inches of clay after it is compacted. The clay should be compacted while it is at optimum moisture. It is important that the clay not be allowed to freeze or dry before the pond is refilled with water. Dry or frozen clay will crack and ruin the watertight seal. The exposed clay can be protected with mulch or straw to prevent this problem.

Bentonite

Bentonite is a type of clay that can also be used to plug pond leaks. When bentonite gets wet, it swells to many times its original size and fills cracks and pore spaces to effectively seal the pond bottom. Bentonite can usually be found at local agricultural supply stores or feed mills, but it may be sold under many trade names.

Similar to the clay blanket described above, bentonite can be applied by draining the pond and applying it directly to the pond bottom. Bentonite works best on coarse-grained materials with low clay content. In this case, the bentonite is applied to the bottom at about one pound per square foot and then mixed to a depth of 3 to 4 inches using a rototiller or similar equipment. It is best to apply bentonite when the soil moisture is optimum for compaction. Keep in mind that bentonite shrinks as it dries, producing cracks in the surface. Therefore, the pond should be refilled as soon as possible. If the surface is likely to be exposed for some time, it should be protected with a layer of mulch or straw to prevent drying. It should be noted that there have been cases where bentonite has been broadcast to the water surface without draining the pond. The theory is that the bentonite will sink to the bottom of the pond, be drawn into the leak, and swell to seal the leaking area. The success of this method is low and seems to be most applicable to very small leaks in shallow water areas where the exact location of the leak can be detected. When successful, this method usually does not work immediately but slowly seals the leak over several days. Successful use of bentonite in this way seems to be more the exception than the rule. In most cases, the pond will need to be drained to expose the leaking surface for repair.

Chemical Additives

Various chemicals may be added to the soil to improve its watertight seal. These chemicals are usually used where the soil already contains adequate clay but is aggregated to allow water movement. This method works best on soils with a relatively high percentage of clay (greater than 15 percent) and is not recommended for more coarse soil, where clay or bentonite should be used. These chemicals break down the soil aggregates and rearrange the soil structure to provide a better barrier to water movement.

The most common chemical additive used for leak repair is sodium polyphosphate. It is spread in small amounts of 0.05 to 0.10 pound per square foot. The chemical should be applied when soil moisture is optimum for compaction and mixed into the top 8 to 10 inches of soil with a rototiller or similar equipment. The surface should then be compacted before refilling the pond.

Plastic Liners

Plastic or vinyl liners can be used in most conditions to seal a leaking pond. They are used most frequently on small ponds or where severe leaks occur repeatedly. These liners can provide a watertight seal under the right conditions, but they are expensive compared to other techniques. Proper installation, especially in joining the sheets together, is critical to ensure their effectiveness. Minimum standards published by the Soil Conservation Service suggest that liners be at least 8 mils thick in fine-textured soil and up to 30 mils thick in very coarse soils. The site should be prepared to eliminate exposed stones or rocks that might puncture the liner. Liners should be protected from punctures with at least 9 inches of soil, especially where the pond is used by swimmers or livestock.

Costs

It is very difficult to generalize the cost of repairing a leaking pond. So many factors can affect these estimates. Replacement of a rusted outlet pipe or sealing a small leak near the top of the pond may be inexpensive. However, draining the pond and sealing the entire bottom may cost thousands of dollars. The use of local clay will be inexpensive compared to bentonite, which may cost \$50 to \$100 per ton without hauling costs. The use of chemical additives may cost up to \$100 per 100 pounds. Plastic liners are often the most expensive alternative at approximately \$25 per square foot or more. Additional costs to consider are equipment rentals (rototillers, rollers, trucks, etc.) and labor.

More Information

More detailed information on sealing a pond or general pond construction can be found in [Agriculture Handbook 590 titled Ponds—Planning, Design, Construction](#).

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