


DESIGN AND CONSTRUCTION



Satisfaction and enjoyment from a pond begin with proper design and construction. A well-designed and constructed pond is a major capital investment. It can enhance property values or be nothing more than an attractive nuisance that may increase insurance costs.

Location

A desirable pond site should have three characteristics: an adequate supply of good quality water, topography that can be economically converted into a pond and soil that will hold water. A well-constructed, properly located pond will provide better service and last longer while requiring less maintenance. Before beginning construction, make a master plan involving the pond and other property features. Plan ahead to avoid later problems. Changes are easy to make on paper but are costly once the pond is built.

A number of questions must be considered seriously during the planning stage: Will the pond be built on owned property or leased property? Will it be a business venture or just a recreational project? Will it be near a public road or the home site, or some distance off the road? What about security and safety? Will the pond be accessible year round? Do you plan to build other ponds later? Will agricultural demands such as irrigation and livestock watering require an auxiliary pond or tank? What about power supply for pumping? Will electricity be required? Will it be single-phase or three-phase electricity?

Before beginning construction, there are even more considerations to address, such as servitudes, rights of way, pipelines, power lines, etc. Will friends or neighbors have fishing rights

and/or hunting privileges? Is there a possible conflict of interest? Will the pond require fencing?

Check with the USDA Soil Conservation Service (SCS) for soil type and topographic maps, as well as aerial photographs. The local office of the SCS can provide valuable assistance in determining if soil types and proposed locations are suitable for pond construction. The Louisiana or U.S. Geological surveys may also have useful maps. Neighbors, surveyors or government planning agencies may also have useful maps and other information.

Although a well-sealed pond with no leakage is the number one concern, adequate drainage is a close second. Where will surplus water go? Fish losses caused by flooding must be avoided. The property's drainage outlet must be considered in the drainage design.

Soil

Depending on the history of the property, you may need to check for pesticides in the soil where the pond will be located. Request help from your local SCS representative to determine how much sand, silt or clay it contains, to a depth of at least 2 feet below the anticipated pond bottom. The soil needs to have about 25 percent clay or silt to seal properly. Avoid any possibility of roots and limbs in the pond levees or bottom.

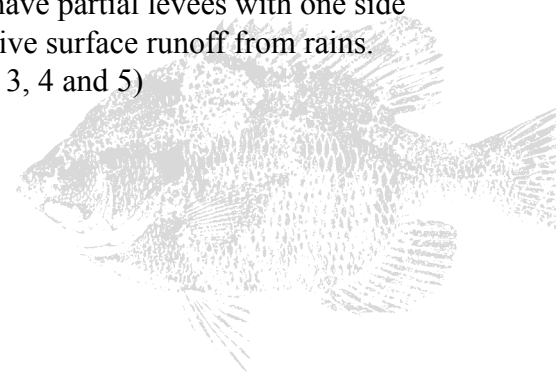
Even where clay content is high, soil compaction over the entire water-holding area is essential. This must be done during construction, using a sheep's-foot roller or heavy tractor. Track vehicles do not compact soil as effectively as these methods.

Pond Size and Shape

Recreational ponds in Louisiana may vary in size from less than half an acre to 20 acres or more. Some factors to consider when

determining the size of a pond include primary and secondary uses, watershed or groundwater yields and cost. Ponds may be irregular in shape, especially dam ponds between two hillsides. On level ground, ponds are frequently rectangular or square with levees on all sides. These are referred to

as levee ponds. A third type of pond is the excavated, or dug out, borrow pit pond. These may have partial levees with one side open to receive surface runoff from rains. (see Figures 3, 4 and 5)



Figures 3 and 4. Various illustrations of pond layouts

Figure 3

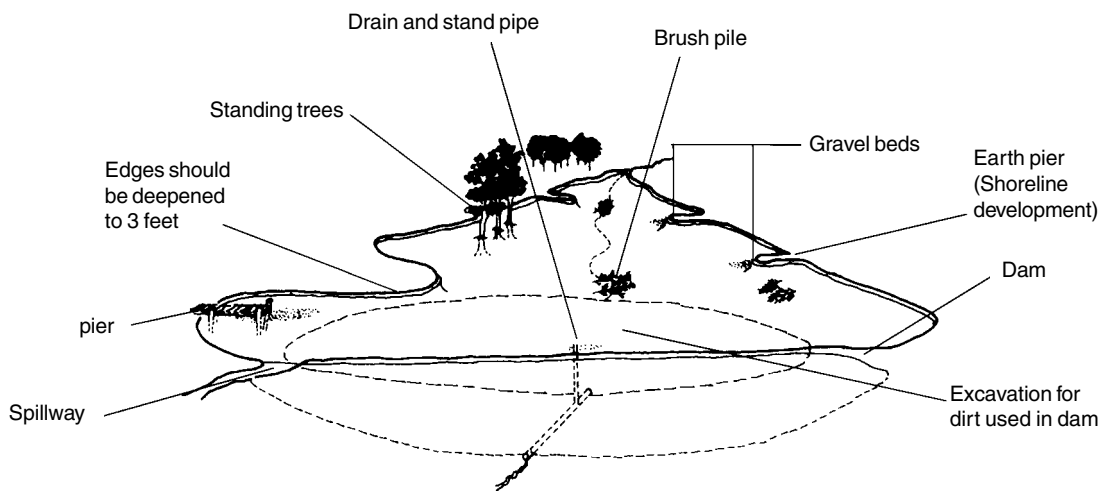


Figure 4

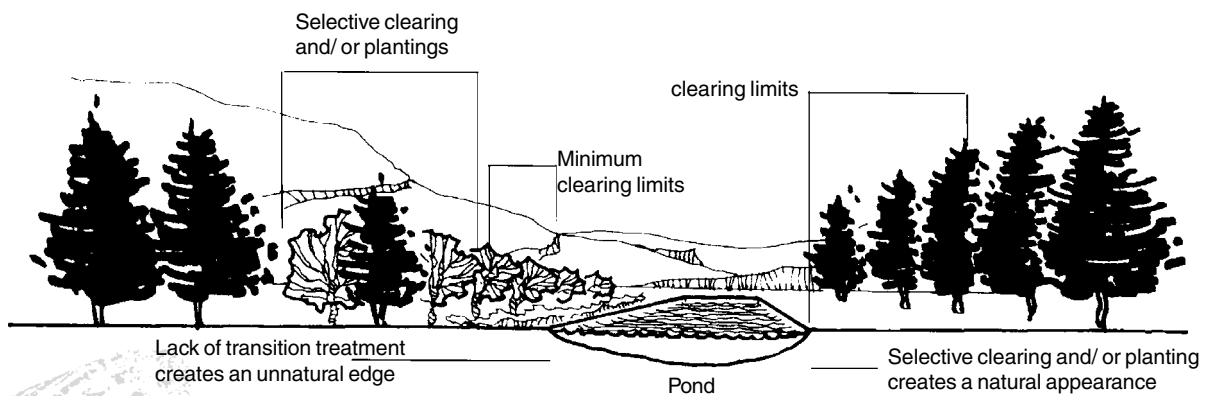
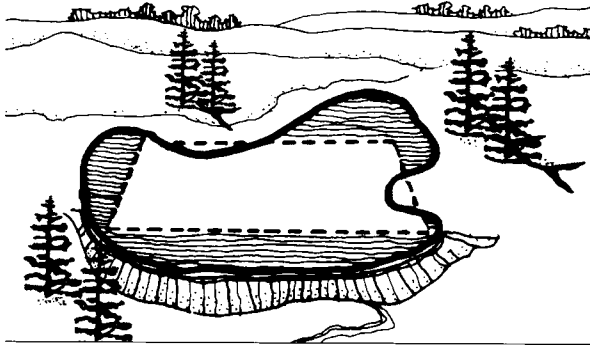


Figure 5. Pond Layout



Water Supplies, Water Loss and Pumping

Pond water may come from rainfall, surface runoff or pumped-in groundwater or surface water. Rain falling directly into a pond will not maintain adequate pond water levels, so watersheds above the pond elevation are used to funnel larger areas of rainfall into many ponds. Watersheds usually range from five to 20 times the pond surface acreage. Heavy clay soils and open pastures allow for smaller watersheds, and sandy soils and forested areas demand larger watersheds. If large portions of a watershed are not properly vegetated, water runoff will deposit excessive amounts of silt in the pond and greatly shorten its productive lifetime.

Avoid excessively large watersheds, because they increase size requirements of levees and associated construction costs. More important, oversized watersheds result in excessive flushing. For the same reason, do not locate ponds over stream beds or ditches where water will flow through continuously. If these situations cannot be avoided, ponds may still be built and managed successfully if a diversion channel can be incorporated into the design at the time of construction.

If groundwater is used for pond filling and evaporation replacement, the well should be located near the edge of the pond or in a central location if more than one pond will be supplied from the same well. If the pond is to be used for irrigation in addition to fishing, water storage should be approximately 1.5 acre feet for each 1.0 acre to be irrigated.

Water is lost from a pond by seepage, drainage, evaporation or overflow. Seepage loss can be minimized by proper sealing and compac-

tion of the pond bottom, levee and sides. However, sand layers or isolated sand pockets and stump holes can cause severe seepage problems and must be avoided. Sudden water loss can occur if a levee fails or a drain pipe cracks or is left open. Depending on the time of year and the elevation of the leak, fish losses may be unavoidable in these situations.

Evaporation is usually negligible in the winter, but can be as much as 1/5 inch per day or more in Louisiana on hot windy days. Unless this water loss is replaced by pumping, the water level will continue to drop until the next rain. These losses can amount to as much as 1 inch per week. A loss of 1 acre-inch in one week is equal to 27,154 gallons, or 3,879 gallons per day.

Pumps used for filling and maintaining ponds are of three general types: (1) centrifugal, (2) deep well-turbine and (3) low lift. A small pump can maintain a pond level once it is full, assuming seepage is small. A pump will require a capacity of about 12 to 15 GPM per pond surface acre to offset a total water loss of 0.3 inches per day, pumping 12 hours per day. This will require 0.5 to 3.0 horsepower, depending on well depth and pressure.

If pumping 24 hours per day and using automatic float controls, the flow rate could be 6 to 7.5 GPM per pond surface acre to offset a total water loss of 0.3 inches per day. A flow rate of 450 GPM is equal to 1 acre-inch per hour and also equal to 1.0 cubic foot per second (CFS). For example: pumping 450 GPM for 12 hours will fill a one-acre pond with 12 inches of water.

Clearing the Pond Site

The entire pond basin, plus an open strip at least 20 feet back from the water line, should be cleared of all trees, stumps, brush, dead branches and other debris. When timber is present, irregular variation in the width of the open strip surrounding the pond will add to a more natural appearance after construction. Old stumps, trees and branches should especially be avoided in the area where the levee will be constructed. These materials will gradually rot if buried in the levee, providing a direct channel for water to leave the pond. The area where the base of the levee will be located should be scraped clean of leaves, grasses, muck and topsoil.

Levees

Although fish pond levees vary widely in height from one site to another, they should be at least 6 to 8 feet high. A minimum average depth of 4 feet should be maintained throughout the year, and design specifications should make sure no part of the pond is less than 3 feet deep to avoid problems with rooted aquatic vegetation. Conversely, water depths of more than 6 feet are generally of little use in Louisiana and do not increase overall fish production.

Depending on how efficiently soil is compacted during the construction process, levees may require 15% to 20% additional height to compensate for settling during the first one or two years. Lighter soils may require use of a central clay core to prevent excess seepage through the levee. This should be determined with your SCS representative during the soil evaluation process.

Pond levees should be 10 to 16 feet wide to accommodate bulldozer construction and vehicle traffic. Side slopes usually vary between 3:1 and 5:1. If you have any doubts regarding design specifications, consult your SCS representative or a qualified engineer.

Levee surfaces should be protected with grass sides, gravel tops and riprap along downwind interiors. Establish a grass cover on new levees as quickly as possible. Common causes of damage to levees after construction include intrusive tree roots, cattle damage, extreme wave action and excessive vehicular traffic.

Drainage

Drain structures and pond locations should allow for complete drainage when needed. Levee ponds need a pipe drain through the levee in the lowest part of the pond for gravity drainage. Otherwise, pump-outs will be necessary sooner or later. A level-control drain pipe is often recommended to regulate water depth automatically. Gate or shear valves should be incorporated outside the levee to allow for easy depth adjustment, especially for winter drawdowns. The inside pipe should be equipped with a screen, cage or gravel-bed filter to prevent clogging or stopping up with mud, vegetation or other debris.

Ponds smaller than eight acres should have 6-inch diameter drain pipes. Ponds from eight to 12 acres require 8-inch pipe, and larger ponds generally require 12-inch diameter drain lines for responsive

water control. Drain pipes should extend at least 2 feet beyond the toe of the levee on both sides. Once drain lines are laid, concrete collars should always be installed at 12-foot intervals before continuing with levee construction.

Rainfall in most parts of Louisiana usually ranges from 45 to 60 inches per year, but this rainfall is distributed variably from day to day and week to week. Because of this variability, a spillway should always be provided for emergency drainage when excessive rains occur. Spillways can be excavated channels or can be constructed with piping equipped with trash racks. Pipe spillways are generally of two types: drop-inlet or hooded-inlet, both of which pass through the levee. Excavated spillways must be wide and flat to avoid erosion and fish loss during heavy water flow. (see Figures 6 and 7)

Your SCS representative can provide guidelines for sizing either type of spillway, but a good rule is to make an excavated spillway width equal to at least 10% of the length of the levee. For long, narrow ponds, increase this amount. To discourage fish from leaving the pond, water flow through the spillway should not exceed 3 inches in depth. Although spillways are usually inactive except during heavy rains, a good turf cover should be established on excavated spillways after construction and maintained at all times. For ponds with large watersheds, levees must be constructed to allow at least 2-2 1/2 feet for temporary floodwater storage while excess water is drained through the spillway.

If water will be required frequently for watering livestock or other purposes, a line can be tied in to the main drain pipe outside the levee and fitted with a gate or float valve to fill a tank, trough or smaller pond. Fencing may be required to discourage livestock from using the main pond. Uncontrolled livestock watering will damage levees and will eventually ruin the fishing in small or moderately sized ponds.

Sealing Ponds

The entire pond bottom must be sealed to a point well above the anticipated waterline to prevent water seepage. This is normally done by using soil with at least 25% clay, which swells when wet to fill in spaces between soil particles. This layer is disked or mixed uniformly and then packed tight with a sheep's-foot roller.

Small amounts of seepage through levees are common in new ponds. This condition usually corrects itself as levees settle and clay particles become saturated and swell. If seepage continues or leaks develop, it may be necessary to drain the pond partially or completely and apply bentonite, a volcanic clay compound, to the inside surface of the levee. SCS representatives can provide advice if this is necessary. Leaks larger than 1/2 to 1 inch in size often require more extensive repairs with heavy equipment after partially or completely draining the pond. Again, contact SCS if leaks persist.

Improvements to Existing Ponds

Most construction-related management problems in existing ponds are the result of insufficient water control or excessively shallow pond edges. Water control can often be improved by installing proper drain structures. In some instances, diversion channels are required to eliminate constant flushing and allow for fertilizer to be retained in the pond. If spillways are not present, they should be installed to minimize levee damage. Shallow pond edges can be corrected by cutting below the water line and using the spoil to build up levees or make points extending out into the pond.

Figures 6 and 7. Drainage structure options

