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Pond Construction:
Some Practical Considerations

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Conservative estimates place the correct number of farm ponds in Virginia at over 50,000. These ponds range in size from less than one acre to over 30 acres in size. Unfortunately, many of these ponds are so poorly constructed that they fail to serve the purpose for which they were originally designed; some may be unsafe.

Until recently, little concern was shown for construction safety in building farm pond dams. Now, however, many states are routinely checking pond dams, and condemning those which are unsafe. Condemned ponds must be drained and repaired or destroyed. Therefore, it is important to properly construct new ponds in order to prevent expensive condemnation or structural failure of the dam.

Farm ponds are constructed for many purposes. Those designed for livestock watering, irrigation, and fire protection must be built near the use they serve and also contain adequate water. Ponds used for flood and erosion control frequently are located in dry valleys or depressions and have the capability for the storage of large quantities of water, especially during heavy rainfall and spring floods.

Ponds constructed for fish and wildlife production or recreation are designed and constructed for (1) easy access, (2) adequate volume and, (3) water level manipulation. Farm ponds can be designed and built to serve multiple purposes with advanced planning. This article is designed to provide basic information needed to design and construct a multiple-use farm pond in Virginia.

Kinds of Ponds

There are two basic types of ponds: embankment and excavation. Embankment ponds, built by placing the dam across a stream, are not recommended because they frequently wash-out. Excavated ponds are made by digging either the pond itself or the surrounding area to form levees. Ponds of this type are recommended and easily constructed, particularly in areas of flat topography.

Selecting the Pond Site

Selection of the pond site is one of the most important steps in construction. A good pond site contains (l) Level topography that provides for economical construction, (2) soil with sufficient clay to hold water and (3) an adequate water supply. Before making the final site selection, one should examine all potential sites considering economics, accessibility and safety. Economically speaking, construct a pond that provides the largest volume of water with the least amount of landfill. Liability is a final consideration. For example, what would happen if the dam failed causing loss of life or injury? The pond owner is normally held liable for downstream flooding and related damages caused by dam failure.

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Level topography will minimize the need for costly soil removal. In most instances, the maximum height of a dam should be 20 to 25 feet. Dams higher than this are expensive to build and frequently stratify in summer resulting in deep water areas unsuitable for aquatic life. Dams in Virginia should be high enough to provide a minimum depth of six feet year-round. Otherwise, dams must be high enough to compensate for continuous evaporation and seepage.

Because a pond is simply a depression for holding water, the dam and bottom must be composed of soil which minimizes seepage. Clay soils are best for lining ponds because they minimize leakage. Sites containing gravel or sandy soils are unsuitable, often requiring costly earth moving. Limestone or shale areas are unsuitable because of possible fractures which create leaks. Swampy areas are poor sites because they are difficult to drain and costly to maintain.

Water Supply

The water supply must be sufficient to rapidly fill the pond and maintain a relatively constant water level—one that does not fluctuate greatly throughout the year. Ponds with large overflows of water flush essential nutrients and allow fish to escape.

Small streams are satisfactory sources of water for most ponds if (l) the flow is sufficient to fill the pond and maintain the water level, (2) the stream is not subject to flooding, (3) the watershed is well vegetated, and (4) the stream carries a little silt load, especially during flood periods. When streams are used as a water supply, a wise precaution is to build the pond adjacent to the stream (not dam the stream) and have an inlet pipe which can be screened or closed as needed. This provides control over siltation and nuisance fish migration.

Another common water source for farm ponds is surface run-off (waters which seep across the surface after rains). In Virginia, pond owners need about 3 acres of land for each acre-foot of pond (a surface acre foot of water one foot deep), except where sandy soils exist or rainfall is variable. In these situations, expert advice from professional engineers is required for predicting available water supplies.

Springs, wells, and ground water provide the best sources of pond water. Ground water usually is of the best quality to support aquatic life. Some well water contains excessive carbon dioxide or nitrogen and must be aerated before being suitable. Some ground water may also contain excess minerals which are harmful to fish and other aquatic life. All waters should be analyzed before pond construction to assure that they are harmless to aquatic life.

Pond Construction

Before construction, the pond owner should estimate the amount of fill for the dam and determine the cost for moving the dirt. Cost of drain pipe installation, spillway construction, clearing the pond area, and other items should be considered.

Once a decision is made to construct the pond, the site should be cleared of all trees and brush. The dam-site area should be marked with toe and grade stakes, all topsoil removed and a core trench excavated. Once the core trench has been filled with high quality clay soil, a drain pipe with anti-seep collars should be installed. Many types of drains are available. The one you choose depends on the costs, availability and suitability. The drain should be of sufficient size to drain the pond in a 3 to 7 day period. Filling the exposed portion of the dam is the most expensive operation in pond construction. All fill should be composed of high quality clay soil applied in thin, well-packed layers. When completed the dam should have a 2:1 slope on the pond side and 3:1 slope on the downward side of the dam. The top of the dam should be 12 feet in width to allow vehicle traffic and prevent muskrats from burrowing through the dam (Figure 1).

Spillway Construction

Inadequate spillway capacity is the main cause of earthen dam failure. All dams require this protection which can be provided by one or several emergency spillways of sufficient size. The spillway should be adequate to release flood waters

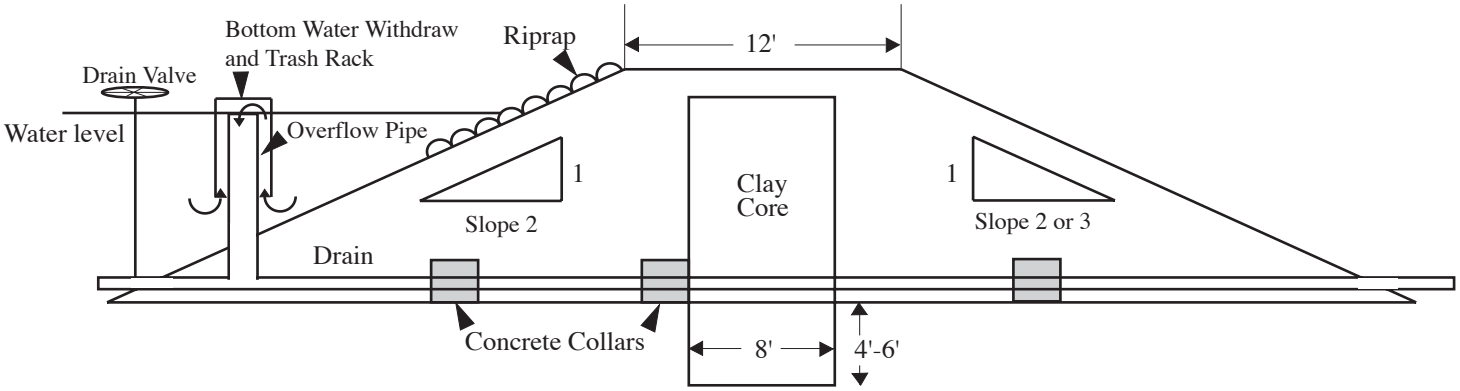

Figure 1

and minimize flows to less than one foot above the spillway. This reduces loss of valuable sportfish and structural damage.

Spillway size should be related to the drainage area. Recommended spillway size can be calculated by adding 15 feet to one-half of the total drainage area acres. For example, a 50-acre drainage area should have 40 feet of spillway, 100 acres requires 65 feet of spillway, and 200 acres requires 115 feet of spillway.

Other Construction Features

1. The pond dam should be grassed immediately after construction to prevent erosion. A permanent species of grass, suitable for your local area, should be used. A quality grass, properly fertilized, will quickly cover to prevent erosion and weed growth and will be easy to maintain.

2. The pond bank should have a 2:1 slope to prevent excessive growth of rooted aquatic weeds. Irregular shaped ponds (non-circular) increase angler access (Figure 2). All pond edges and piers should be sodded with a suitable permanent species of grass.

3. The pondside face of the dam can be protected from wind and wave action by riprapping the face of the dam with rock. Riprap should extend several feet below the low anticipated water level.

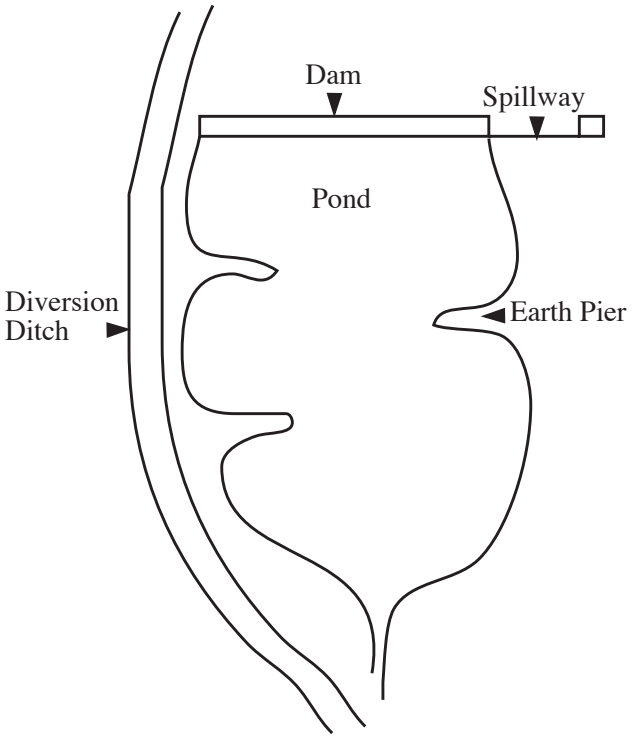

Figure 2

4. Livestock should be excluded from ponds by fencing. A gravity-flow watering trough can be installed below the dam for livestock water.

5. Pond inlets should be constructed so that inflows can be controlled and filtered. The filter prevents unwanted fish species from entering the pond (Figure 3), and a good outlet design prevents fish loss (Figure 4).

6. In drainage areas that contain silt or heavy loads of toxic chemicals, the surface runoff waters should be diverted via a ditch around the pond. Diversion ditches prevent excess turbidity, siltation, fertility and fish kills.

7. Inspect and repair your pond periodically. Fill gullies, replant grass, and riprap as needed. Mow pond edges to prevent woody plant growth and promote easy access.

8. Advice in planning and constructing ponds may be obtained from either the Soil Conservation Service or from Virginia Cooperative Extension. Additional literature on this subject is available from these agencies.

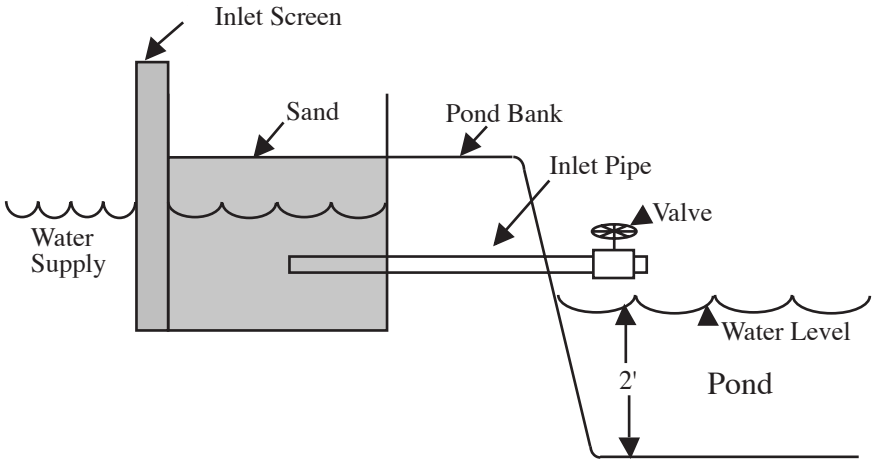

Figure 3

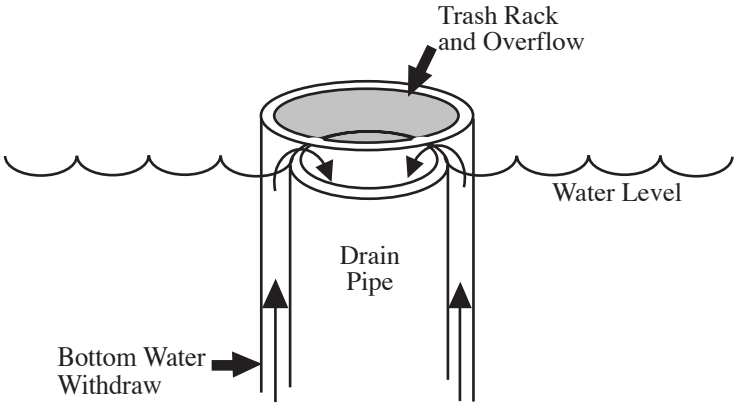

Figure 4

Reviewed by Michelle Davis, research associate, Fisheries and Wildlife