

can be helpful in diverting unwanted overland runoff away.

Ponds dug by draglines are seldom wider than about 90 feet but may be much longer. Excavation width is governed by the distance a dragline can move back before it is blocked by its spoil piles—unless the spoil can be moved.

## Impoundments

In “embankment” or “fill-type” ponds, water is impounded by an earthen dam containing a core of watertight material. Such ponds are suited to areas where slopes range from gentle to steep. It is best to have a site where a great volume of water can be stored by only a small amount of embankment fill. The ideal location is where the valley is narrow at the damsite, and the pond area is wide and flat but with steep sides.

For fishing ponds, avoid damming a stream. As described earlier in this chapter, they are collecting basins for silt, sediment, and debris, and undesirable fish species can easily enter the pond. One or more permits may

be needed depending on applicable state laws. Also avoid sites where the impoundment dams a river or stream and where there is flooding.

Wave erosion on the dam embankment can be a problem in large ponds. Try to choose a site where the prevailing wind doesn't blow along the length of the pond toward the dam.

A properly designed impoundment will have two outlets for the water—a trickle tube or mechanical spillway and a vegetated earthen emergency spillway. The emergency spillway is for flood flows.

As in the case of dug ponds, it will be best for fish if the water supply is from groundwater rather than from runoff. If, however, the impoundment must be designed to catch runoff water, the pond must be located so that its drainage basin is large enough to provide sufficient runoff to fill it—and to maintain it in the face of evaporation and seepage losses. Calculate surface runoff according to the area of land draining into the pond, amount of precipitation, and runoff characteristics involving land slope and porosity, vegetation, and human disturbances of

the land. For a Michigan pond that depends entirely on runoff water, 8 to 14 acres of runoff basin land are needed per acre of pond surface.

Clay and silty clay are good soils for impoundment beds. Sandy clay is suitable only if the cost of extra materials for sealing the pond is acceptable. Sites in some areas of limestone or gypsum are especially unsuitable—even hazardous—for impoundments. There may be crevices allowing water to drain from the pond. A fair clue to the success of building impoundments in such areas is the previous experience of nearby pond owners.

Soils for earthen dams should be about 20% clay by weight and contain a wide range of particle sizes, varying from fine sand to coarse sand or gravel. The earth must be compacted to minimize percolation through the dam. To insure proper compaction, soil moisture must be controlled in certain ways during construction.

For the dam's vegetated spillway, clay, sandy clay and silty clay are suitable. Avoid loose sand and other easily erodible soils.