Excavated Ponds

Pond Classification

Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the auxiliary spillway elevation is 3 feet or more.

Excavated Ponds

Excavated ponds are the simplest to build in relatively flat terrain. Because their capacity is obtained almost solely by excavation, their practical size is limited. They are best suited to locations where the demand for water is small. Because excavated ponds can be built to expose a minimum water surface area in proportion to their volume, they are advantageous in places where evaporation losses are high and water is scarce. The ease with which they can be constructed, their compactness, their relative safety from flood flow damage, and their low maintenance requirements make them popular in many sections of the country.

Types of Excavated Ponds

Two kinds of excavated ponds are possible. One is fed by surface runoff and the other is fed by ground water aquifers, usually layers of sand and gravel. Some ponds may be fed from both of these sources.

Pond Location Surface Flow

Excavated ponds fed by surface runoff can be located in almost any kind of topography. They are, however, most satisfactory and most commonly used in areas of comparatively flat, but well-drained terrain. A pond can be located in a broad natural drainage way or to one side of a drainage way if the runoff can be diverted into the pond. The low point of a natural depression is often a good location. After the pond is filled, excess runoff escapes through regular drainage ways.

Surface Flow Soils

If an excavated pond is to be fed by surface runoff, enough impervious soil at the site is essential to avoid excess seepage losses. The most desirable sites are where fine-textured clay and silty clay extend well below the proposed pond depth. Sites where sandy clay extends to adequate depths generally are satisfactory. Avoid sites where the soil is porous or is underlain by strata of coarse-textured sand or sand-gravel mixtures unless you are prepared to bear the expense of an artificial lining. Avoid soil underlain by limestone.

Pond Site

Completed Pond

Pond Location Subsurface Flow

Excavated ponds fed by ground water aquifers can be located only in areas of flat or nearly flat topography. If possible, they should be located where the permanent water table is within a few feet of the surface.

Subsurface Flow Soils

If an excavated pond is to be fed from a water-bearing sand or a sand-gravel layer, the layer must be at a depth that can be reached practically and economically by the excavating equipment. The water-bearing layer must be thick enough and permeable enough to yield water at a rate that satisfies the maximum expected demand for water and overcomes evaporation losses.

More Subsurface Soil Flow

Thoroughly investigate sites proposed for aquifer-fed excavated ponds. Bore test holes at intervals over the site to determine the existence and physical characteristics of the water-bearing material. The water level in the test holes indicates the normal water level in the completed pond. The vertical distance between this level and the ground surface determines the volume of overburden or excavation needed that does not contribute to the usable pond capacity, but may increase the construction cost considerably. From an economic standpoint, this vertical distance between water level and ground surface generally should not exceed 6 feet.

Pond Site


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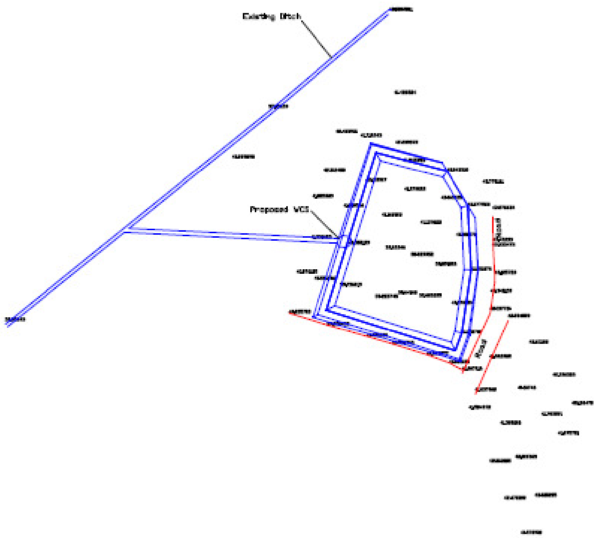
Existing Ditch
Proposed WCS

Under Construction

Pond Volume

The volume of excavation required can be estimated with some accuracy by using the prismoidal formula:

$$V = \frac{(A + 4B + C)}{6} \times \frac{D}{27}$$

where:

V = volume of excavation (yd3)

A = area of the excavation at the ground surface (ft2)

B = area of the excavation at the mid-depth (1/2 D) point (ft2)

C = area of the excavation at the bottom of the pond (ft2)

D = average depth of the pond (ft2)

27 = factor converting cubic feet to cubic yards

Design Volume

Design for square half acre pond:

150 ft x 150 ft = 22500 sqft = 0.52 acre

Use 2:1 side slope : SS = 2

Pond depth is 10 ft from top of bank to bottom : D = 10

$$V = \frac{(A + 4B + C)}{6} \times \frac{D}{27}$$

A = TL x TW = 150 x 150 = 22500

C = BL x BW

BL = TL – (2 x SS x D)   BW = TW – (2 x SS x D)

C = 110 x 110 = 12100

B = ML x MW

$$ML = TL - \frac{(2 \times SS \times D)}{2} \qquad MW = TW - \frac{(2 \times SS \times D)}{2}$$

B = 130 x 130 = 16900

$$V = \frac{(22500 + 4(16900) + 12100)}{6} \times \frac{10}{27}$$

V = 6309 cubic yards

What if SS = 1

Design for square half acre pond:
150 ft x 150 ft = 22500 sqft = 0.52 acre
Use 1:1 side slope : SS = 1
Pond depth is 10 ft from top of bank to bottom : D = 10

$$V = \frac{(A + 4B + C)}{6} \times \frac{D}{27}$$

A = TL x TW = 150 x 150 = 22500
C = BL x BW
BL = TL – (2 x SS x D)   BW = TW – (2 x SS x D)
C = 130 x 130 = 16900
B = ML x MW

$$ML = TL - \frac{(2 \times SS \times D)}{2} \qquad MW = TW - \frac{(2 \times SS \times D)}{2}$$

B = 140 x 140 = 19600

$$V = \frac{(22500 + 4(19600) + 16900)}{6} \times \frac{10}{27}$$

V = 7272 cubic yards

Water Volume

Water Depth is only 8 feet in our 10 foot pond. WD = 8

Pond is still 150 x 150 at surface.

Freeboard is 2 feet Side Slope is 2:1

Water Surface area is not 150 x 150.

TL for water surface = TL at surface - (2 x SS x Freeboard)

TL(ws) = 150 – (2 x 2 x 2) = 142

TW(ws) = 150 – (2 x 2 x 2) = 142

A = 142 x 142 = 20164

C is still C because the bottom is the bottom : 12100

B = ML(ws) x MW(ws)

$ML(ws) = TL(ws) - \frac{(2 \times SS \times WD)}{2}$ $MW(ws) = TW(ws) - \frac{(2 \times SS \times WD)}{2}$

ML(ws) = 126 MW(ws) = 126

B = 126 x 126 = 15876

$V = \frac{(20164 + 4(15876) + 12100)}{6} \times \frac{8}{27}$ V = 4729 yd3 4729 yd3 x 27 = 127683 ft3

127683 ft3 x 7.48 = 955069 gallons

What Water Volume if SS = 1

With SS = 2

$$V = \frac{(20164 + 4(15876) + 12100)}{6} \times \frac{8}{27}$$

V = 4729 yd3

4729 yd3 x 27 = 127683 ft3

127683 ft3 x 7.48 = 955069 gallons

With SS = 1

$$V = \frac{(21316 + 4(19044) + 16900)}{6} \times \frac{8}{27}$$

V = 5649 yd3

5649 yd3 x 27 = 152523 ft3

152523 ft3 x 7.48 = 1140872 gallons

An additional 185803 gallons was gained by using a 1:1 side slope.

That is a 19.5 percent gain in water volume using 1:1 side slope while using the same 0.52 acre footprint.

A lot of Soil

How many Trucks

Single axle - maybe 8 yd3

Double axle - maybe 10 to 12 yd3

Three axle – maybe 15 yd3

7000 yd3 / 15 yd3 = 467 trucks

What Can (can't) You Do With Your Soil

- You can not allow it to leave the farm (unless you have a mining permit with DENR DEMLR)
- The farm means one contiguous tract of land (land may be separated by a state road but must be directly across the road)
- Can not take it to another farm any distance down a state road (even if owned by the same person)
- You can not use it to fill wetlands without permit from US Army Corps of Engineers and DENR DWR
- You can use it to build up farm roads on the contiguous tract of land
- You can use it to build up low areas in fields on the farm (if you use it here make sure to take soil samples and lime and fertilize)
- You can leave it as a mountain (must be seeded and mulched)