DESIGN OF FARM POND

Farm ponds are small tanks or reservoirs constructed for the purpose of storing water essentially from surface runoff. Farm ponds are useful for irrigation, water supply for the cattle, fish production etc.

The design and construction of farm ponds require a thorough knowledge of the site conditions and requirements. Some sites are ideally suited for locating the ponds and advantage of natural conditions should always be taken.

Types of Ponds

Depending on the source of water and their location with respect to the land surface, farm ponds are grouped into four types. These are (1) Dugout ponds (2) Surface ponds (3) Spring or Creek fed ponds and (4) Off-stream storage ponds.

Dugout Ponds are excavated at the site and the soil obtained by excavation is formed as embankment around the pond. The pond could either be fed by surface runoff or groundwater wherever aquifers are available. In case of dugout ponds, if the stored water is to be used for irrigation, the water has to be pumped out.

Surface water ponds are the most common type of farm ponds. These are partly excavated and an embankment is constructed to retain the water. Generally a site which has a depression already is chosen for this pond construction.

Spring or creek fed ponds are those where a spring or a creek is the source of water supply to the pond. Construction of these ponds, therefore, depends upon the availability of natural springs or creeks.

Off-stream storage ponds are constructed by the side of streams which flow only seasonally. The idea is to store the water obtained from the seasonal flow in the streams. Suitable arrangements need to be made for conveying the water from the stream to the storage ponds.

Components of a Farm Pond:

Figure below shows a typical layout of a farm pond. The pond consists of the storage area, earthen dam, mechanical spillway and an emergency spillway. The mechanical spillway is used for letting out the excess water from the pond and also as an outlet for taking out the water for irrigation. The emergency spillway is to safeguard the earthen dam from overtopping when there are inflows higher than the designed values.

Design of Farm Pond

The design of farm ponds consists of

(1) Selection of site

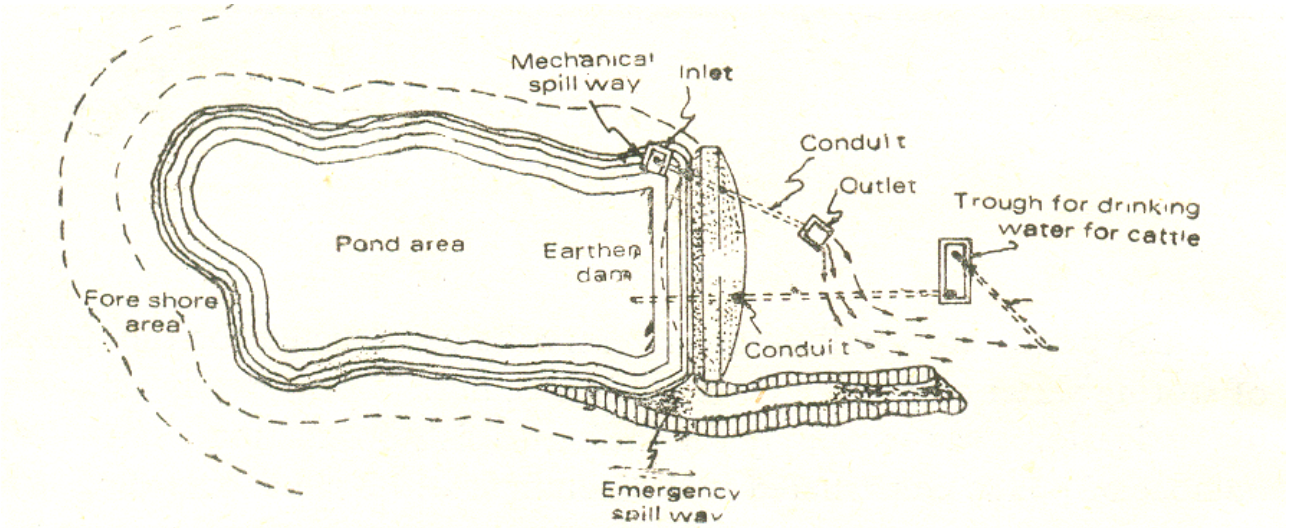
(2) Determination of the capacity of the pond

(3) Design of the embankment

(4) Design of the mechanical spillway

(5) Design of the emergency spillway

(6) Providing for seepage control from the bottom



(1) Selection of site

Selection of suitable site for the pond is important as the cost of construction as well as the utility of the pond depend upon the site. The site for the pond is to be selected keeping in view of the following considerations:

1. The site should be such that largest storage volume is available with the least amount of earth fill. A narrow section of the valley with steep sides slopes is preferable.
2. Large areas of shallow water should be avoided as these will cause excessive evaporation losses and also cause water weeds to grow.
3. The site should not cause excessive seepage losses.
4. The pond should be located as near as possible to the area where the water will be used. When the water is to be used for irrigation, gravity flow to the areas to be irrigated is preferable.

Capacity of the Pond

The capacity of the pond is determined from a contour survey of the site at which the pond is to be located. From the contour plan of the site the capacity is calculated for different stages using the trapezoidal or simpson's rule.

For this purpose, the area enclosed by each contour is measured using a planimeter. According to the trapezoidal rule, the volume V between two contours at an interval H and having areas A_1 and A_2 is given by,

$$V = \frac{H}{2}(A_1 + A_2)$$

Using Simpson's rule the volume between any odd number of contours is given by,

$$V = \frac{H}{3}\left[\begin{array}{l}\text{Twice the area of odd contours} + 4 \text{ times area of even contours} + \\ \text{Area of the first and last contours}\end{array}\right]$$

This formula is also known as the prismodial rule. For using this equation, the number of contours should be odd i.e. the number of intervals considered should be even.

Example:

Calculate the capacity of a pond given the area enclosed by different contours at the site as follows:

S. No.	Contour Value (m)	Area Enclosed (m^2)
1.	250	220
2.	251	290
3.	252	340
4.	253	370
5.	254	480
6.	255	550
7.	256	620

Contour interval = 1 m

Solution:

Using trapezoidal formula,

$$V = 1*100\left(\frac{2.2*6.2}{2} + 2.9 + 3.4 + 3.7 + 4.8 + 5.5\right) = 2450\,m^3$$

Using prismoidal formula,

$$V = \frac{1}{3}*100\left[2.2 + 4(2.9 + 3.7 + 5.5) + 2(3.4 + 4.8) + 6.2\right] = 2440\,m^3$$

To plot the depth-capacity curve the following table can be prepared. Trapezoidal formula is used to calculate the volume increments.

Contour value	Area enclosed	Volume increment	Cumulative volume
250	220	-	-
251	290	255	255
252	340	315	570
253	370	355	925
254	480	425	1350
255	550	515	1865
256	620	585	2450