**Specific Design Considerations**

**1. Water sources used for fishponds**

Water sources can be spring water, seepage water, rainwater or run-off, tidewater (marine ponds), water from bore holes (wells), or water pumped or diverted from a river, lake, or reservoir.

**2. Quantity of water needed**

Make a decision on the type of fish to be cultured and the size of ponds, so as to determine the amount of water required.

Consider the climatic condition of the area, rainfall pattern, and nature of the soil when calculating quantity of water.

A general rule is that pond water inflow and outflow should equal the pond volume over the period of a month. If inflow is too low, water quality may suffer from oxygen depletion and/or the accumulation of toxicants. However, if the inflow is too high, large amounts of beneficial algae may be flushed from the pond.

As a rule of thumb, ponds should fill up in less than a week. For small ponds, e.g., ponds smaller than **200 m2, 1-inch pipe is recommended**. **A 400-m2 pond needs a 2-inch pipe**, while a **pond larger than 4000 m2 will require a 4-inch pipe**

**Steps to pond Construction**

1. Survey the land

2. Clear all vegetation from the site

3. Remove the topsoil from the site

4. Determine pond, drain pipe, and supply canal elevations

5. Peg out the pond, including core trenches and dyke tops

6. Dig core trenches and pack them with good soil

7. Excavate the pond area

8. Build the dykes

9. Install the drainage system

10. Install the water supply system

**Factors for Selecting Type of RWH**

Several criteria maybe necessary to assess when considering practicing RWH, these have been summarized below:

1. **Cost**

The cost of various techniques usually varies depending on the materials and infrastructures used in various techniques. Costs for ground catchment techniques are usually higher than costs for roof catchment techniques. **As an alternative, the cost of installing and operating a rainwater harvesting systems should not be substantially higher than other water supply options.**

1. **Location and Topography**

Location and topography play a vital role in adoption of ground catchment techniques, as they require land with appropriate surrounding and slope.

1. **Land Availability**

The land on which RWH infrastructure is, should be free from other uses. Whereas **ground catchment techniques are applicable where huge size** of land is available, **roof catchment techniques can be applied with only small size of land** and in a decentralized manner.

1. **Source of Pollutants**

Catchments, which are close to pollution sources, should be avoided. These may include **rooftops in the proximity** of **industrial smokes**, **dust** and **tree litters**, and **ground catchments**, which are **exposed to wastes** from **animal** and **human activities.**

**The quality of rainwater should be safe for human consumption.**

1. **Hydrological Conditions**

Rainfall amount and its trend should be considered in selecting appropriate type of

RWH. Ground catchment techniques are appropriate in areas with high amount of rainfall in short periods of the year, whereby huge volume of water can be harvested and stored for use during dry season.

1. **Social & Environmental Considerations**

Water harvested for drinking and other purposes has to be culturally accepted by the users. Moreover, the functioning of a RWH system should have minimal negative implication on the environment, and in the long run contribute to improved water cycle, reduced flooding effects and recharge of groundwater sources among others.

1. **Geological Conditions**

The amount of water, which can be harvested, on the ground catchment is relative to the nature of soil, whereas physical and chemical composition of soil also affects the quality of water.

The importance of getting an accurate estimation of your pond surface area cannot be overestimated. The majority of pond owners visually estimate their pond area, which usually results in an overestimate of the true pond surface area. Pond area and water volume should be calculated based on some simple measurements. The effort necessary to estimate pond surface area is directly related to your pond's shape and uniformity. The simplest method--using basic equations for common shapes--can be applied if your pond closely resembles a circle, square, rectangle, or trapezoid in shape.

**Pond Shapes**

1. **Circular**

Pond shape can be estimated by measuring the distance around the pond shoreline in feet. Square the shoreline distance and divide by 547,390 to get the pond area in acres. For example, a pond that is 450 feet around the shoreline would have an area = (450 feet)2 / 547,390.

1. **Rectangular or square**

shape area is estimated by simply measuring the length and width of the pond sides in feet. Multiply the length times the width to get the square feet of surface area. This value can be converted to acres by dividing by 43,560 ft2/acre. So, a pond that measures 150 feet long and 100 feet wide would have an area = 150 feet X 100 feet = 15,000 ft2

1. **Trapezoid**

Many ponds may be roughly rectangular in shape, but one side may be significantly shorter than the other. The area of this shape is best estimated using a formula for a trapezoid by taking the average length of the two unequal sides and multiplying by the width of the pond. For example, a pond that is 200 feet long on one side, 300 feet long on the opposite side, and 100 feet wide would have an area = 250 feet X 100 feet = 25,000 ft2

1. **Irregular Shaped**

Many ponds have an irregular shape where the surface area cannot be adequately estimated using the formulas for common geometric shapes. Three methods can be used in this case depending on the degree of accuracy you desire. Keep in mind that the accuracy of your pond surface area estimate may be very important, especially for the safe use of aquatic herbicides. The three methods are described in order from least to most accurate. You should strive to use the most accurate method that you can reasonably accomplish.

1. **Average Length and Width Method:**

Take numerous measurements to determine the average length and average width. Make certain you get both the longest and shortest distances in calculating the average length, and the widest and narrowest distances for determining the average width. The more measurements that you make, the more accurate your result will be. The area is then calculated by multiplying the average width times the average length. If you do your measurements in feet, your result will be in square feet. Depending on the number of width and length measurements made, the final area will probably be within about ±20 percent of the actual pond surface area.

1. **Multiple Trapezoids Method:**

A more accurate method to determine the area of an odd-shaped pond is to divide the pond into multiple trapezoid shapes. A new trapezoid is defined anywhere the shoreline makes a rapid change in direction. Note that instead of horizontal transects, this method requires measurement of the distance between each vertical transect. This would be most easily done during winter when the pond is frozen and the transects could be easily laid out and measured. This method requires more measurement and effort, but the final area estimate will probably be within ±5 to 10 percent of the actual pond area.

1. **Handheld Global Positioning Systems (GPS):**

Handheld GPS systems have become quite common over the past five years as they have become more affordable. They are now routinely used for outdoor recreation (hunting, hiking, camping, etc.) and navigation. GPS units allow you to determine your exact location on earth using multiple satellites in space. Various locations, or "waypoints," can be stored in the GPS unit for use with mapping software that either accompanies the unit or can be purchased separately. The software can connect the waypoints and calculate the area inside the resulting shape.

1. **Geographical Information Websites:** There are also geographical information programs on the internet, like Google Earth or Bing Maps, which use satellite imagery to display a map of your pond or lake. These website tools can make it very easy to determine the surface area of your water resource.

A pond surface area could be estimated by walking the perimeter of the pond and stopping at various waypoint locations along the pond shoreline. If waypoints are stored at each location where the pond shape changes, the resulting area will be extremely accurate, probably within 1 percent of the actual pond area.