PROBLEMS

Answers to odd-numbered problems will appear at the end of the book.

1. A farmer has a reservoir with vertical sides and a surface area of 2.5 ac. Following the rainy season, the reservoir is filled to a depth of 3.0 m. During the dry season the reservoir loses 2.5 in. of water per week (wk) to evaporation. If the average irrigation demand during the dry season is 0.23 ac-ft per day, for how many weeks can the farmer irrigate from the reservoir?

2. How long must a pump with a capacity of 12 gal/min pump to fill a tank with a capacity of 37 m^3?

3. A circular water transmission pipe has a diameter of 1.0 ft and is 8.3 mi long. How much water does it take to fill the pipe?

4. If the water is flowing into the pipe of Problem 3 at a velocity of 1.3 feet per second (ft/s), what is the rate at which the pipe is transmitting water?

5. A small urban watershed has an area of 16.34 mi^2. A summer storm drops an average of 1.50 in. of rain over the entire watershed. If 50% of the rainfall runs off the watershed into surface-water bodies, what is the volume of runoff:
   A. In cubic inches?
   B. In cubic feet?
   C. In cubic meters?

1.1. The annual evaporation from a lake, with a surface area of 1600 hectares, is 3 meters. Determine the average daily evaporation rate in hectare-centimeters per day during the year.

1.2. Rainfall takes place at an average intensity of 1 cm/h over a 250-hectare area for 3 days. Determine the average rate of rainfall in cubic meters per second (m^3/s). Determine the 3-day volume of rainfall in hectare-cm and hectare-meters. Also determine the 3-day volume of rainfall in centimeters of equivalent depth over the 250-hectare area.

1.3. Water is to be supplied from a reservoir fed by a stream with a discharge of 2 m^3/s to meet domestic requirements of an area with a population of 150,000. The average daily consumption is 300 liters per person. The lowest discharge of the stream is 0.25 m^3/s for a period of 15 days. Determine the reservoir size in km^3 and the rate of outflow when the reservoir is full.

1.4. Compute the time required to fill the reservoir in Exercise 1.3 when the demand of the population is being simultaneously fed by the stream and the reservoir is empty after a drought period. The stream discharge is 1.75 m^3/s.

1.5. An area is being irrigated by a stream with a drainage area of 300 km^2. The drainage area contribution is 0.1 m^3/s/km^2. Determine the discharge of the channel and the area irrigated if 0.37 m^3/s are required per 1000 hectares.

1.6. The average monthly precipitation in a watershed of 4500 km^2 is 46 cm. If the cumulative losses are 20% of precipitation, determine the area of Exercise 1.5 that can be irrigated with the remaining water. Also calculate the channel discharge.

1.7. Estimate the storage capacity of a reservoir for Exercise 1.6 when the average precipitation is 28 cm for a period of 20 days. The area calculated above is to be continuously supplied with its full demand.

1.8. Water is to be supplied to an area for both domestic and agricultural purposes. The population is 200,000 and the area to be irrigated is 3600 hectares. Water is to be pumped from the river. If the average daily consumption is 320 liters per person and the agricultural demand 0.33 m^3/s/1000 hectares, find the number of pumps required when 30% of the pumps are required to be standby. Also calculate the minimum discharge in the river to meet the above demand. The individual pump capacity is 0.1 m^3/s.