HANDOUT #4

WATER DEMAND

Knowledge of the quantity of water needed to satisfy the requirement of the community is necessary in the design of any water supply system. In rural areas, water is utilized mainly for domestic consumption. The factors affecting domestic consumption are:

1) Size of the community.
2) Standard of living of the consumer.
3) Quality and quantity of water available.
4) Cost of water to consumers.
5) Habits and manner of usage of the consumers.
6) Climate.
7) Livestock, poultry, hogs and other animals being raised by the residents.
8) Plants and gardens being maintained by the residents.

In addition to domestic consumption, allowance should be made for leakages and pilferages. Ideally, this should not be more than 15% of the total water sent to the distribution system.

3.01 TERMINOLOGY AND DEFINITIONS

1) **Water Consumption** — Amount of water consumed by all residents, institutions, etc. when provided with water service facilities.

2) **Water Demand** — The sum of water consumption and unaccounted for water.

3) **Unaccounted For Water** — The amount of water losses thru leakages and pilferages.

4) **Average Day Demand** — The Average Day Demand is the sum of the daily water demands in one year divided by the number of days of that year.

5) **Maximum Day Demand** — Largest one-day water demand. In the example cited the day with the highest water demand is the maximum day demand. Normally this occurs during dry season generally on a Monday.

6) **Maximum Hour (Peak Hour) Demand** — Any hour of the day when the water demand is at its maximum. In most places this occurs early morning at 7 or 8.

7) **Design Period** — The number of years in which the proposed system and its component structures and equipment are expected to serve the population adequately.

8) **Design Population** — the population of the area to be served within the design period.

8.02 DESIGN CRITERIA

The objectives of the design criteria are to establish goals such that if the criteria are met, consumers will receive water at reasonable quantities and cost. However, during the planning process, it may be necessary to modify the criteria to accommodate special requirements of the locality.

8.03 DEMAND FACTORS

In planning, it is always important to know the maximum or peak hour demand, maximum day demand, average day demand and the distribution of demand throughout the day. The maximum hour demand is the most critical factor in establishing pipe, pump and reservoir sizes.

8.04 DESIGN PERIOD

The effective life of the project is dependent upon the size and source of the water supply system, the life span of pumps, pipelines, and storage tanks, and the availability of funds to finance the project. For rural water supply systems, the design periods recommended for the following appurtenances are:

1) Pumps: 5.0 years
2) Wells, pipelines, and storage tanks: 5 years, but the life of the system may last up to 20 years.

8.05 DESIGN POPULATION

The design population is equal to the present population multiplied by 1.15. Stated mathematically:

$$Pp = 1.15 * P$$

where: Pp = Projected population at the end of the design period
P = present population

*Based on 3% annual increase of population for the design period of 5 years (0.03 × 5 = 0.15)

8.06 WATER CONSUMPTION RATES STUDY ON PUBLIC FAUCET SYSTEM AND INDIVIDUAL HOUSEHOLD CONNECTION

A study was conducted to determine the water demands in rural areas. The description of the study area and the result of the investigation is

presented in detail in Appendix J. Basing on the outcome of this study, the following figures are recommended:

1) Water Consumption Rates
   - Public Faucet System — 60 LPCD
   - Household Connection — 100 LPCD
2) Average Day Demand — Design Population × Water Consumption Rate
3) Maximum Day Demand — 1.30 × Average Day Demand
4) Maximum Hour Demand
   - Less than 100 HH or 600 persons — $\frac{3.0 \times \text{Average Day Demand}}{24}$
   - More than 100 HH or 600 persons — $\frac{2.5 \times \text{Average Day Demand}}{24}$

8.07 WATER CONSUMPTION FIGURES

Water consumption varies greatly depending upon its usage and the number of users. In rural areas, it is mainly utilized for domestic purposes, i.e., for drinking, cooking, bathing, and washing. Shown in Table 8.1 are the average water consumption rates obtained from different sources.

Table 8.1

WATER CONSUMPTION RATES
(in liters per capita per day, LPCD)

Use	Cairncross & Feachem	Wagner & Lanoix	Wright F.B.	DCCD*
1) Public Faucet	20	15	—	60
2) Individual Household Connection	200	250	208	100
3) Combined Public Faucets and some Household Connection	—	—	—	80

*Water losses included.

Example 8.1 Sample Problem in Computation of Water Demand

Date:
Barrio : Sinisian, East Lemery, Batangas
Population : 703

Design Criteria:
Water Consumption Rate : 60 LPCD
Peaking Factor : 2.5 (population is more than 600 persons)

Analysis:

1) **Calculate the Design Population**

   Pp = 1.15 P
   = 1.15 (703) = 808

2) **Calculate the Average Day Demand**

   Average Day Demand = Design Population × Water
   = Consumption Rate
   = 808 × 60
   = 48,480 LPD

3) **Calculate the Maximum Day Demand**

   Maximum Day Demand = 1.3 × Average Day Demand
   = 1.3 × 48,480 LPD
   = 63,024 LPD

4) **Calculate the Maximum Hour Demand (Peak Hour)**

   Maximum Hour Demand= 2.5 × Average Day Demand
   = 2.5 × 48,480 ÷ 24
   = 5050LPH

5) **Significance of Various Water Demand Figures:**

   a.

   Average Day Demand
   1) Used in the design of reservoir capacity.

   b.

   Maximum Day Demand
   1) Used in determining the minimum pump capacity. (Except in Hydropneumatic Pressure System)

   c.

   Maximum Hour Demand
   1) Used in estimating the diameter of transmission and distribution mains.
   2) Used in estimating the minimum pump capacity in Hydropneumatic Pressure System.

REFERENCE:

The World Bank Office Manila(2012). *Rural Water Supply Design Manual, Volumes 1-3*, Water Partnership Program, Manila, Philippines: World Bank