6.0 DATA REQUIREMENTS AND LAYOUT

The proper identification of the type of data required and collection of reliable data plays a major role in planning, design and construction of successful drainage system. This exercise forms an essential pre-requisite for drainage investigations, selection of type of drainage system required, design and construction of drainage system. The data requrirements would depend on the type of problem, objectives of the project, its importance and allocation of funds. The reliability, adequacy and representativeness of the basic drainage data governs the proper drainage planning, design and construction of adequate and successful drainage plan.

One of the most important issue in drainage planning is to ascertain as what could be the cause(s) of drainage problem in the given area. It could be due to (a) high rainfall, (b) soil & sub-soil, (c) topography, and (d) man made problems. Therefore, the basic data must provide a knowledge of a (a) rainfall pattern, (b) amount, source, movement and chemical characteristics of water to be drained, (c) nature of surface & subsurface soils and their capacity to transmit water, and (d) available hydraulic gradients, both natural and man made, so as to identify the causes of drainage and arrive at the suitable remedial measures. Additionally, the data pertaining to the effects of drainage on socio-economic environment is also required to make the system/plan more effective.

6.1 Type of Data

The information on following aspects are essential for design for drainage system and planning.

6.1.1 Climate

i) Rainfall: The data on rainfall intensity, duration, amount and distribution for various frequencies. The temporal distribution of rainfall is required to identify the critical season during which excess rainfall may cause damage. Depth duration-frequency relations could be used to determine drainage design discharge.

ii) Type of Climate: Humid, arid or semi-arid climate. By and large, the need for drainage arises principally due to excess water resulting from rainfall in humid areas and irrigation in arid and semi-arid areas.

iii) Other meteorolgical data such as pan evaporation, humidity, air velocity and temperature may also be collected from nearby observatory.

6.1.2 Topography

Topographic maps showing land slopes, length of slope, location & direction of natural drainage, low lying areas, potential outlets and other special conditions affecting drainage are of prime importance. The study of such maps and reconnaissance survey can reveal a clue to the type of drainage needed and the arrangements of drains. There is no hard and fast rule for the scale of maps to be used. It basically depends upon the size of area, purpose of investigation and type of details required. Scale could be 1:25,000 for reconnaissance survey of relatively larger areas. For smaller areas and detailed studies it could be 1:5000, 1:2500. While planning a drainage system for farms it may be even 1:500 or so for detailed design and layout. The contour interval of 1 to 1.5 m may be satisfactory for areas with considerable topographic relief in preliminary studies. For actual drainage layouts and relatively flat topography, a contour interval of 0.3 to 0.5 m may be good enough.

6.1.3 Outlet conditions

Condition and adequacy of channel/waterway below the outlet to receive drainage runoff is to be examined. It requires data on elevation of maximum flood level in the waterways, difference of elevation between outlet and maximum flood level and size of waterway.

6.1.4 Soils & Sub-soils

The characteristcis of surface & sub soil, and substrata is of primary concern in drainage design. The hydraulic conductivity or coefficient of permeability of the soil which refers to the capability of soil to Transmit water is the most important information to be collected. Since hydraulic conductivity is interrelated with many other factors, therefore the data regarding other soil properties e.g. texture, structure, specific yield, is required. The soil characteristics determine the selection of type of drains i.e. surface or sub-surface. Incase of soils having low permeability surface drains are recommended. Detailed soil investigation is necessary while going in for sub-surface drains.

The data regarding sub strata is necessary to find if there is any barrier stratum, barrier layer, hard pans or clay layers of low permeability which restricts the vertical movement of water and causes water logging in the effective root zone depth.

The data on specific yield in the 1-3m zone would tell the danger of water logging. It may be noted that when specific yield is less than 3 percent drainage becomes difficult and expensive.

6.1.5 Salinity and Alkalinity

In some of the areas problem of salinity is built up through evapotranspiration of capillary ground water and irrigation water containing salts. This problem is common in arid and semi-arid regions. Proper drainage is provided to back down the salts below the effective root zone depth. Therefore, data on pH, electrical conductivity and exchangeable sodium percentage (ESP) is required. Electrical conductivity of irrigation water and the permissible level of Ec in the soil are required to work out leaching requirement (LR). A map showing salt affected areas may be prepared for this purpose.

6.1.6 Crop Requirements

Different crops have differing tolerances to excess water, both as to amount and time. During doormant period of plant growth, saturation of roots do not seriously affect the growth. Different crops have differing root zone depths also. Shallow rooted crops for a given condition would have different drainage requirements that of deep rooted crops. It is the refore necessary to collect data on type of crops their tolerance to water logging, effective root zone depth, water requirement etc.

6.1.7 Ground Water table

Plant-root growth is severly affected by rise in water table. The height of water table rise is required to be controlled to check drainage problem. For this information on water table e.g. watertable contour maps, depth-to water table maps, ground water fluctuation maps and ground water quality maps is needed, for that area. Location of existing wells and their pumpages may also be needed.

6.1.8 Type of Irrigation System

The information on canal irrigated areas, capacity of canals, condition of canals and field channels etc. (i.e. lined or unlined) and method of irrigation being adopted must be compiled.

6.1.9 Existing Drainage Facilities

Information regarding the capacity, type and condition of existing drainage facilities, if any may be collected and location shown on composite map. It would help in planning new system of drainage.

6.1.10 Surface Runoff

The data on topography, soils, vegetative cover, land use and rainfall can be used to compute storm runoff using any standard formula or by SCS curve

number method. For designing surface drains frequencies of 5 to 25 years is sufficient. 25 years frequency may be considered for expensive structures. Another most practical way of estimating surface drainage requirements for storm runoff is by studying existing channels and culverts or using measured runoff data, if available. Gupta, Tejwani and Rambabu (1971) have determined drainage coefficients for cereal crops, rice and vegetable crops for various regions of India and have also developed drainage runoff curves for these crops based on 5 years frequency.

6.1.11 Drainage Coefficient

Drainage coefficient (i.e. depth of water to be removed for field in a day) depends on the crop tolerance, hydraulic conductivity of soil, size of area, rainfall and other climatic factors. Drainage coefficient generally varies from 6 mm to 25 mm and maximum upto 50 mm in case of open drains. In tile drains it is asumed to be between 6 to 18 mm depending on soil and crop type. Therefore, depending upon above factors a suitable value of drainage coefficient may be assumed to work out drainage discharge from the area.

6.1.12 Availability of machines and Construction Material

Information regading the availability of type of machines/equipments, labour and construction material like bricks, stones, cement, sand, tiles, pipes etc. may also be collected.