Certificate Course on Participatory Irrigation Management (PIM)

Module 7- Water Measurements and Water Distribution by Water User Associations (WUAs)

Topic 7.1 – Objective of water measurements, discharge structure and units

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Objective of water measurements, discharge structure and units

Topics of Module 7:

7.1 Objective of water measurements, discharge structure and units

7.2 History of Warabandi

7.3 Implementation of Warabandi in current scenario

7.4 Emerging trends in Warabandi

It is essential, for distributing any commodity equally, to know its exact quantity, meaning by how much it measures, what is its quantity. It will enable us to precisely distribute the commodity. In this section we will try to know about the objectives of water measurements, main water measuring instruments along with their suitability for the use of WUAs.

1) Objectives of Water Measurement:

The Water Users' Associations have to distribute the water themselves among farmers after receiving it from water resources department. It is essential for managing and distributing the water to know about its quantity, volume etc. Until and unless we do not have its exact quantity, we will not be able to manage and distribute it exactly. Accordingly, WUAs have three main objectives of measuring water:

1. Verification of contracted quantity of water received from department. By measuring water, the WUA may know that the quantity of water running in canal is the same as was promised by department.

2. Equitable distribution of water among farmers.

3. Measuring water at its different places, the capacity and condition of canal may be estimated.

These points are discussed in module 11 in details and may be seen there.

1.1. **Units of Water Measurement: -** Water is measured in two shapes,

i. stored water in volumetric measures,

ii. Running water in volume flowing per unit time.

The water stored in ponds, reservoirs etc is measured in volume in units of cubic feet, cubic meter, or if the water is in the large amount, then it is measured in thousand cubic feet, thousand cubic meter, million cubic meters. In extra large volumes it is described as hectare meter (meaning by 1 meter water is placed over an area of 1 hectare) or when a country's water is assessed it is described in million-hectare meter or cubic kilometre. It is measured by measuring length x breadth X height / depth in meters or feet.

The running or flowing water is measured in cusecs, (cubic feet per second), cumecs (cubic meter per second). These are the normal units. In some large unit cusec hour (meaning by 1 cusec water flowing for 1 hour) or 1 cusec day. Now a days the water flowing in small channels is also measured in litres per second. These units are also described in module 5. You can also refer that module.

Exercise: -

i. Write normal unit of flowing water.

ii. Write a large unit of measuring volume.

iii. Compare your answers to para 1.1.

1.2. Fixed water measuring instruments: - This category of water measuring instruments includes the instruments which are fixed or in built at site of the canal. These include 'weirs' & 'flumes. These work on use of a single reading, hence easy in working. WUAs may easily learn their use. A table relating discharge on various readings is handed over to WUAs. WUA may ask any person with primary education to bring reading from the site and calculate discharge of the channel without trouble.

These fixed instruments mainly include:

i. Weirs (Examples: Rectangular Free Fall Weir and V-Notch)

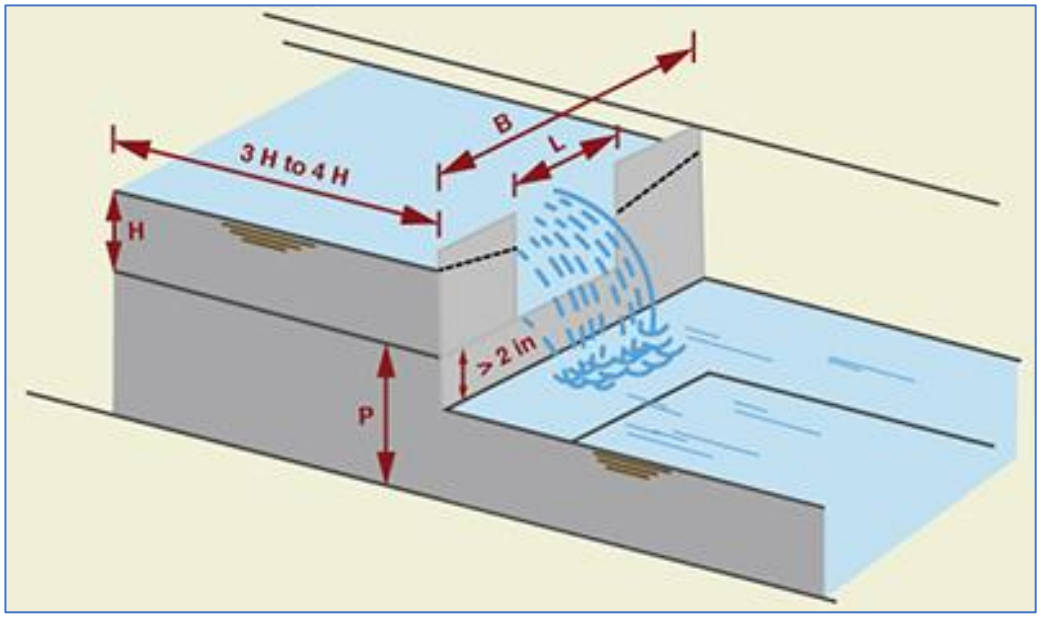
ii. Flumes (Examples: Parshall Flume and Cut -Throat Flume)

These are the simplest structures and easy to use. The abovementioned weirs and flumes are described below:

Rectangular Free fall weir:

These structures in their simplest form are constructed at the head of canals. Water falls in the canal running over these structures. A reading of water depth flowing over the weir may be noted and discharge may be had from the table already prepared basing on the formulae.

Fig-1 Rectangular weir



V- Notch:

In its simplest form, it is a 90^0 angular structure which is shown below (Please see Fig-2). It is generally used to measure discharges of relatively small canals with notch constructed at its head. Readings of its various depths are marked on its slanting plates. These depths are related to discharges calculated using formula and a table is prepared for various depths. In this instrument also a person having primary education can take the reading on plates and the corresponding discharge can be seen from the table.

Fig -2 V-Notch

Parshall Flume structure:

These structures are developed by a hydrologist named Parshall.

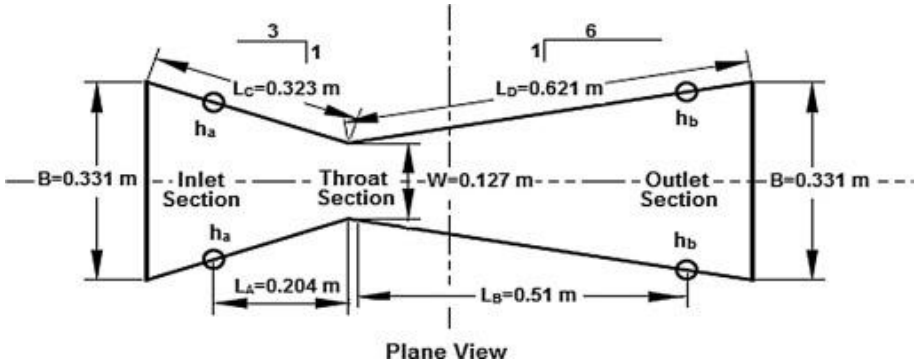
These structures are available in various throat dimensions and length according to discharging capacity. These structures can be constructed in canals in fixed ratios for various length and throat measurement. These are suitable for measuring discharges of minors and small distributaries. Measuring discharges of large canals using these structures may pose difficulty. The depth of water at throat can be read by the observer on a painted scale and the corresponding discharge can be seen from a depth-discharge table already prepared using the formula. (please see the Fig-3 below)

Fig 3 Parshall Flume Structure

Cut-Throat Flume:

These structures are used for measuring small discharges generally of outlet channels. This structure can be constructed at site and also be used as portable structure. Discharges can be computed at various depths for different throat width. This structure is also simple in use like other structures. A person with primary knowledge can take reading at marked/ engraved gauges and assess discharge using a table already prepared using relevant formula.

Fig 4 Cutthroat Flume Structure.



Movable discharge measuring instruments: - A sort of training is required for using these instruments for discharge measurement. WUA office bearers may feel difficulty in it, therefore the details are not being given, only a very brief description of the instrument is given here.

Current Meter

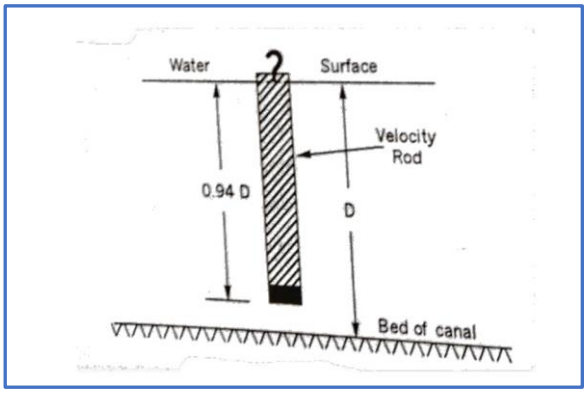
Fig 5: Current Meter

As shown in above figure, there are various types of current meter available in market which measure the flow velocity of canal section at any desired point directly on the digital screen multiplying it with cross sectional area of canal the discharge may be known.

Velocity / Discharge rod:

Velocity or discharge rods are also used to measure the discharges of canals. It is a 1-2 inches wide strip or rod. Its tip at bottom is made so heavy that it can swim vertically in canal water emersed about 90% in water. It works on the assumption that will give average velocity.

Fig 6: Velocity Rod/ Discharge Rod



It is used in the straight reaches of canal with plane or regularly sloping bed.

Pigmy Current Meter:

Both the above instruments are used for measuring discharges of large canals whereas the pygmy current meter may be used to measure the discharges of minors and even outlet channels especially at such places where velocity is lesser than 3-4 feet per second.

Fig 7: Pygmy Current Meter