

# Stream Gauging

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Stream:- A stream is a body of water with surface water flowing with in the bed and banks of a channel.

Depending on its location or certain characteristics a stream may be referred to by a variety of local or regional names. Long large streams are usually called rivers.

The study of streams and waterways in general is known as surface hydrology.

Stream Flow:-

Stream flow or channel runoff is the flow of water in streams, rivers and other channels and is a major element of the water cycle.

Water flowing in channels comes from surface runoff from adjacent hillslopes, from groundwater flow out of the ground and from water discharged from pipes.

The water that makes up our streams and rivers is derived from two sources.

1) Direct runoff:- It is a consequence result of precipitation.

2) Base flow:- It is the water flow that results from the seepage of groundwater out of stream banks.

Introduction:-

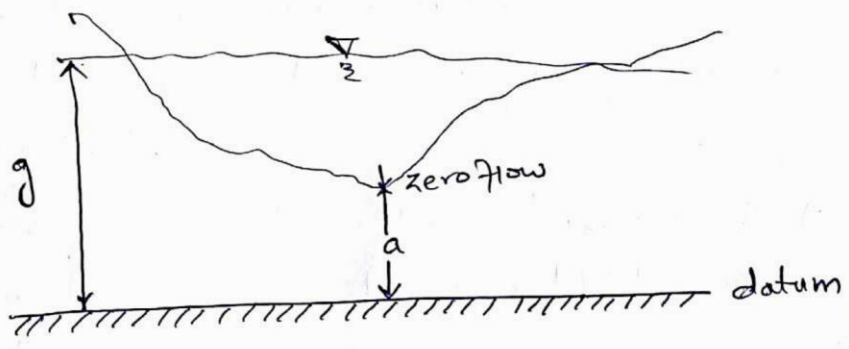
Among various hydrologic networks, Stream flow is the largest operation. The necessity of stream gauging arises because of many reasons; streams provide water supply for man and animals, irrigation water for vegetation and energy for production of power. Records of stream flow are important in each of these uses -

Water in streams can also be a hazard - Floods cause extensive damage and hardships. Records of flood events obtained at gauging stations serve as the basis for the design of bridges, culverts, spillways, reservoirs etc.

River stage:-

River stage is an important concept when analyzing how much water is moving in a stream at any given moment.

Also River stage is a term used in stream gauging. It is the elevation of the water surface at a specified station above arbitrary datum.



(3)  
The zero elevation is some-time taken as mean sea level but more often it is set slightly below in the stream.

The river stage is denoted by "g" shown in given sketch.

Stage is the water level above some arbitrary point usually with the zero height being near the river bed, in the river and is commonly measured in feet.

For example:- on a normal day when no rain has fallen for a while, a river might have a stage of 2 feet - Similarly if a big storm hits, the river stage could rise to 15 or 20 feet -

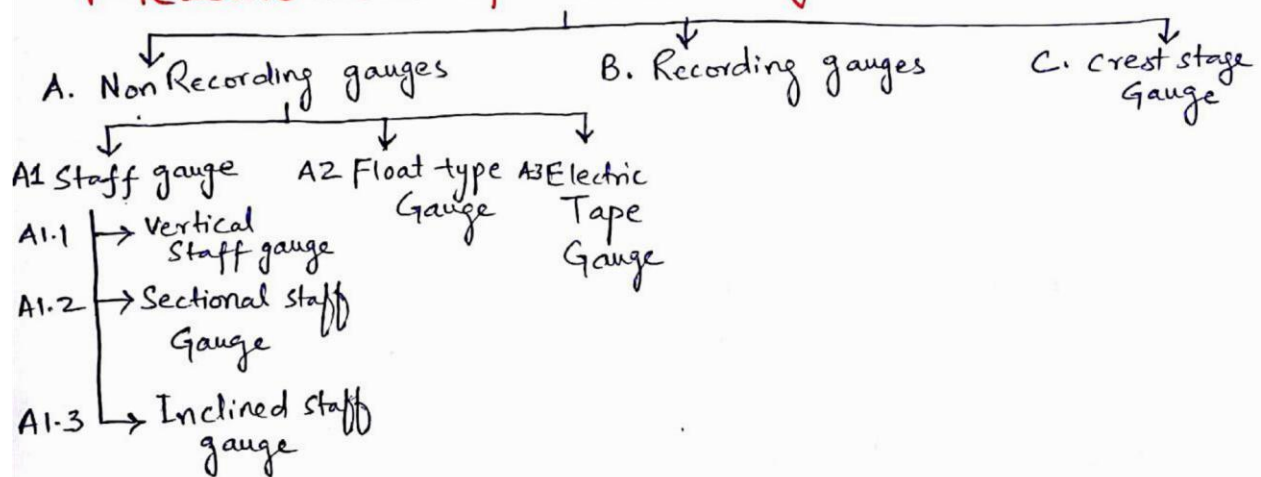
### Selection of a Gauging Site:-

The following factors have to be considered in selecting a site for a stream gauging station.

- 1) The section should be straight and uniform for a length of about 10 to 20 times the width of the stream.
- 2) The bed and banks of the stream should be firm and stable so as to ensure consistency of area-discharge relationship. (i.e) the cross section should not be subjected to change by silting, during different stages of flow; a smooth rock, shingle or clay bed is favourable

- (3) The bed and banks should be free from <sup>(4)</sup>vegetal growth, boulders or other obstructions like bridge piers etc.
- (4) Permanence of Control
- (5) Possibility of no backwater effect from downstream tributaries or other sources.
- (6) Availability of a good metering station where good discharge measurement can be made.
- (7) The stream gauging station should be easily accessible, accessibility of the site by roads, particularly during floods.
- (8) Availability of powerline or telephone lines where needed for special instrumentation.

## Measurement of River stages.



### A1.1 Vertical staff Gauge:-

The simplest way to measure river stage is by means of staff gauge - A portion of the vertical staff gauge is immersed in the water at all times.

The gauge may consist of a single vertical scale attached to a bridge pier or other structure that extends into the low water channel of the stream.

Figure below shows a typical vertical staff gauge.

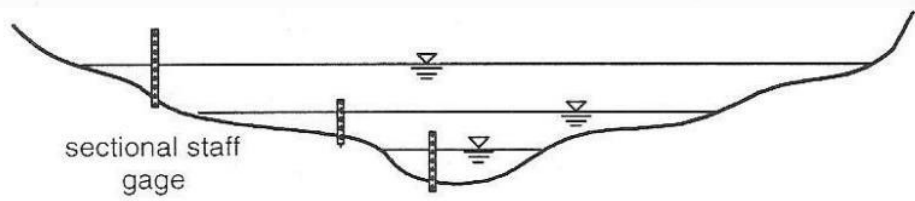


### A1.2 Sectional staff Gauge:-

If no suitable structure exists in a location which is accessible at all stages a sectional staff may be used.

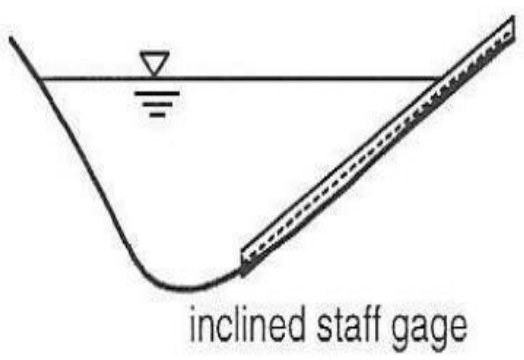
Short sections of staff are mounted on available structures or on specially constructed supports in such a way that one section is always accessible.

The sectional staff gauge is shown in figure below.



### A1.3 Inclined staff Gauge:-

An alternative to the sectional staff gauge is an inclined staff gauge as shown in figure. Inclined staff gauge is placed on the slope of the stream bank and graduated so that the scale reads directly in the vertical depth. The inclined staff gauges are considered better than the sectional staff gauges due to better accuracy.

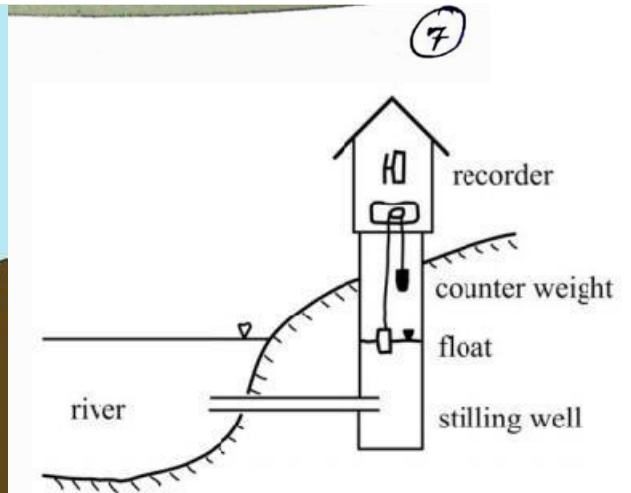
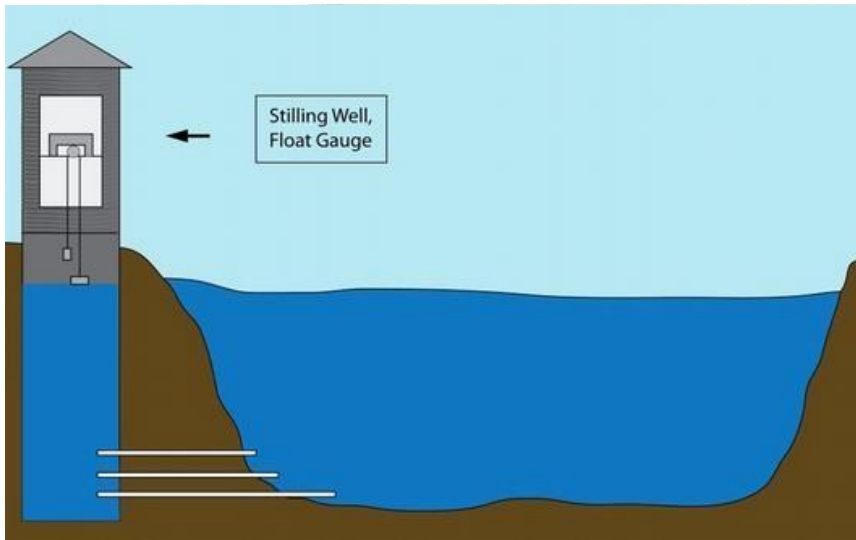


### A2 Float Type Gauge:-

This gauge is generally used as an inside reference gauge and is installed in a stilling well to avoid wave effects - The stilling well is 1.20m in diameter or with inner dimensions 1.20m x 1.20m - It is built on side of a bank

A pipe connects well to river at its lowest level. The gauge consists of a float, graduated steel tape, counter weight and a pulley.

A float gauge provide a direct data of river stage. Construction of stilling well is expensive, also maintenance cost is more when rivers carry large amount of Sediments.



### A3 Electric Tape Gauge:-

It consists of a graduated steel tape, a cylindrical weight, a reel for the tape, a battery and voltmeter. Heights can be measured directly by unreeling the tape into its river or stilling well. One terminal of the battery is attached to ground connection to the terminal of voltmeter. The other terminal of the voltmeter is connected through weight of the tape. The weight is lowered until it touches the water surface. This contact completes the electric circuit and produces a signal on the voltmeter. The tape reading is then taken. This gives river stage with respect to datum on the site. To find stage with respect to datum addition/subtraction will be required.

This method is quite accurate and generally used to find river stage as shown in figure:-



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### B. Recording Gauges:-

These are similar to the non-recording gauges but have some arrangement to give a continuous record. In recording gauges motion of a float for example, is recorded on a chart, and in a continuous recorder the motion of the float moves a pen across a long strip chart. The chart is usually 25cm wide and at a scale of 1:12. The chart roll contains enough paper to operate for a year at a scale of 6cm/day.

### C. Crest stage Gauge:-

During high floods, staff gauges can not measure the stage since they will be totally under water.

- \* For such times crest stage gauges provide information about the flood water levels.
- \* They are installed at electricity polls, trees or other suitable structures like bridges, at height locations.



- \* A variety of gauges have been devised, including small floats which rise with the increase in stage but are restrained at the maximum level.
- \* water soluble paints on bridge piers where they are protected from rain and can indicate a definite high water mark - The piers of bridge are repainted after a flood.
- \* The gauge used by US geological Survey consist of a length of vertical pipe containing a graduated staff fits inside the pipe with help of cork. The cork floats as the water level rises. The graduated staff can be removed for recording.

