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Indian Standard

FORMS FOR RECORDING MEASUREMENT OF FLOW OF WATER IN OPEN CHANNELS

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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FORMS FOR RECORDING MEASUREMENT OF FLOW OF WATER IN OPEN CHANNELS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 2 January 1960, after the draft finalized by the Fluid Flow Measurement Sectional Committee had been approved by the Building Division Council.

0.2 Measurement of flow of water in open channels involves accurate and precise recording of several types of observations. These observations may relate to the instruments used, the situations under which the observations are taken or the actual length, area, velocity and location of objects by angles and distances. The recording of the observations should be such as to facilitate calculation of the final value in a simple, direct and convenient manner. Observations once taken will also form part of permanent historical records of conditions of flow at that time. In view of these exacting requirements, the standard forms for recording measurement of flow should be convenient and simple for use by the field personnel and elaborate and clear enough for later calculation and transfer into the year books.

0.3 The Sectional Committee responsible for the preparation of this standard has taken into consideration the views of research laboratories, irrigation departments and other technologists and has related the standard to the practices followed in the country in this field. Furthermore, due weightage has also been given to the need for international co-ordination among standards prevailing in different countries of the world in this field. These considerations led the Sectional Committee to base this standard largely on Standards for Methods and Records of Hydrologic Measurements: Flood Control Series No. 6 (ST/ ECAFE/SER. F/6) issued by the United Nations Economic Commission for Asia and the Far East.

0.4 This standard is one of a series of Indian Standards on measurement of flow of water through open channels. Other standards in the series are:

IS : 1191-1959 GLOSSARY OF TERMS USED IN MEASUREMENT OF FLOW OF WATER IN OPEN CHANNELS

IS : 1192-1959 VELOCITY-AREA METHODS FOR MEASUREMENT OF FLOW OF WATER IN OPEN CHANNELS

IS : 1193-1959 METHODS FOR MEASUREMENT OF FLOW OF WATER IN OPEN CHANNELS USING NOTCHES, WEIRS AND FLUMES

0·5 In view of the Government of India's decision to introduce in the country a uniform system of weights and measures based on the metric system, all recordings are indicated in metric units.

0.6 In recording measurements or reporting results in accordance with this standard, if the final value, observed or calculated, is to be rouded off, it shall be done in accordance with *IS : 2-1949 Rules for Rounding Off Numerical Values.

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1. SCOPE

1.1 This standard lays down the forms for recording measurement of flow of water in open channels The forms covered are:

Form 1 Record of Gauges,

Form 2 Record of Water Level,

Form 3 Weekly Sheet Showing Hourly Record of Water Level During Flood Period,

Form 4 Record of Cross-Section,

Form 5 Computation of Discharge from Float Measurement,

Form 6 Computation of Discharge from Current Meter Measurements,

Form 7 Computation of Discharge by Slope Area Method, and

Form 8 Composite Form for Record of Daily Discharge Data.

*Since revised.

2. STANDARD FORMS

FORM 1 RECORD OF GAUGES

No ..... Station .....

River System ..... Name of Stream .....

Longitude ..... Latitude .....

Bench Marks

No. of Bench Mark	Date of Installation or Re-survey	Elevation	Datum of Elevation	No. of Reference Point	Date of Installation or Re-survey of Reference Point	Location of Reference Point	Distance of Reference Point to Bench Mark
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Gauges

No. of Gauge	Date of Installation or Re-installation	Zero of Gauge			No. of Reference Bench Mark	No. of Reference Point	Date of Abandonment
		Elevation	Datum of Elevation	Date of Survey or Re-survey			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

NOTE — A map should be attached to this record, showing the locations of the bench marks, gauges and reference points.

FORM 2 RECORD OF WATER LEVEL

Station ..... River System ..... Name of Stream .....

Record from ....to .....

Catchment Area Up to the Gauge Site .....

Maximum Water Level in the Month ..... on ..... Duration ..... hr

Minimum Water Level in the Month ..... on ..... Duration ..... hr

Date	Gauge No.	Zero of Gauge	Gauge Reading						Mean Gauge Reading	Mean Water Level	Maximum Water Level	Minimum Water Level
			0700 hr		1300 hr		1900 hr					
			Gauge Reading	Water Temp* °C	Gauge Reading	Water Temp* °C	Gauge Reading	Water Temp* °C				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1												
2												
3												
...												
...												
...												
29												
30												
31												

*The water temperature is taken 30 cm (or 1·0 ft) below the surface. Where the depth is less, temperature is taken at the bed level.

FORM 3 WEEKLY SHEET SHOWING HOURLY RECORD OF WATER LEVEL DURING FLOOD PERIOD

Station .....River System.....Name of Stream.....

Record from.....to.....

1) DATE								
2) WATER TEMPERATURE	0700 hr (a)							
	1300 hr (b)							
	1900 hr (c)							
3) GAUGE NO.								
4) ZERO OF GAUGE								
5) TIME OF OBSERVATION	0100 hr 0200 hr 0300 hr .... 2200 hr 2300 hr 2400 hr							
6) MEAN OF GAUGE READING								
7) MEAN WATER LEVEL								
8) MAXIMUM WATER LEVEL*								
9) MINIMUM WATER LEVEL*								

Time and date of occurrence of flood peak and corresponding gauge .....

*If the maximum water level or minimum water level should occur in between hourly readings, it shall be recorded as such and not as the hourly reading.

FORM 4 RECORD OF CROSS-SECTION

Station .....River System..... Name of Stream.....

Gauge No ..... Zero of Gauge.....Method of Measurement.....

Started ..... hr.....19..... Gauge Reading.....Water Level..... Water Temperature (°C).....

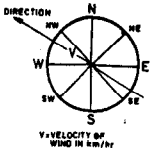
Completed .....hr .....19.....Gauge Reading ..... Water Level.....Water Temperature (°C).....

CROSS-SECTION NO.						CROSS-SECTION NO.					
Measuring Point	Angle or Distance	Reduced Distance	Depth	Average Depth	Area of Section	Measuring Point	Angle or Distance	Reduced Distance	Depth	Average Depth	Area of Section
(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)

FORM 5 COMPUTATION OF DISCHARGE FROM FLOAT MEASUREMENT

Station ..... River System ..... Name of Stream ..... Date of Measurement ..... Time ..... Length of Base Line .....
Distance of Theodolite Along Base Line from (a) Upper Cross-Section ..... (b) Lower Cross-Section ..... Kind of Float .....
Gauge No ..... Gauge Zero ..... Gauge Reading Started ..... Completed ..... Mean ..... Mean Water Level .....
Water Temperature Started ..... Completed ..... Mean Water Temperature ..... Wind Direction ..... E, W, N or S Wind Velocity ..... km/hr.

Mark wind direction and velocity as shown in the diagram



Record of Measurement						Computation of Velocity							Computation of Discharge					
Float No.	Colour of Flag	Reading of Angle		Time		Distance from Left or Right River Bank		Distance Between the Chosen Sections	Duration of Travel	Velocity			Area			Mean	Mean Velocity of Segment	Discharge of Segment
		Upper Section	Lower Section	Upper Section	Lower Section	Upper Section	Lower Section			Surface	Coefficient	Mean	Segment No.	Upper Section	Lower Section			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
																	Total	

FORM 6 COMPUTATION OF DISCHARGE FROM CURRENT METER MEASUREMENTS

Station ..... River System ..... Name of Stream ..... Date of Measurement ..... Time from ..... to ..... Method of Measurement : Wading/Cable/Boat/Bridge
Type and No. of Current Meter ..... Equation ..... Date of Last Rating .....
Spin Before Measurement ..... After ..... Weight Used ..... Gauge No. ..... Gauge Zero ..... Mode of Suspension .....
Gauge Reading Started ..... Completed ..... Mean ..... Mean Water Level ..... Water Temperature Started ..... Completed ..... Mean Water Temperature .....

Condition of Water { Fairly Clear / Ordinarily Silty / Intensely Silty } Wind Strength { Very Slight / Slight / Strong / Very Strong }

Wind Direction ..... Wind Velocity .....

Record of Measurement													Computation of Discharge								
Time	Gauge Reading	Water Level	No. of Vertical	Reading of Angle or Distance	Reduced Distance from Bank	Depth	Depth of Measuring Point	Time Interval in Seconds	Revolutions	Revolutions per Second	Velocity	Drift (Metres)	Angle of Current with Section	Velocity Corrected for Drift	Correction for Angle of Current	Final Corrected Velocity	Final Corrected Mean Velocity of a Vertical	Final Corrected Mean Velocity of Two Adjacent Verticals	Surface Width of Segment	Mean Depth	Area	Discharge
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
																					Total	

Mean Velocity of Cross-Section ..... Name of Observer ..... Designation ..... Signature ..... Date .....

As in the Original Standard, this Page is Intentionally Left Blank

FORM 7 COMPUTATION OF DISCHARGE BY SLOPE AREA METHOD

River System ..... Name of Stream .....

Location of Observation Site ..... Time and Date of Measurement .....

Water Level or High Water Mark in the Upper Section	Water Level or High Water Mark in the Lower Section	Difference in Levels Between the Two Sections	Length of Reach	Water Surface Slope (S)	Upper Section			Lower Section			Average Area	Average Wetted Perimeter	Average Hydraulic Mean Depth	Coefficient of Rugosity 'n'	Velocity	Discharge	Remarks
					Area (A)	Wetted Perimeter (P)	Hydraulic Mean Depth (A/P)	Area (A)	Wetted Perimeter (P)	Hydraulic Mean Depth (A/P)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)

NOTES — (1) Velocity should be computed by Manning's formula: $V = \frac{R^{\frac{2}{3}} S^{\frac{1}{2}}}{n}$ in m/s.

(2) 'n' should be based on the actual value previously determined.

(3) Area of cross-section should be computed using Form No. 4 preferably from flood time observations. If this is not possible, sections should be observed at the earliest opportunity after the floods.

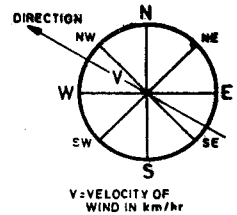
Name of Observer ..... Designation .....

Signature ..... Date .....

FORM 8 COMPOSITE FORM FOR RECORD OF DAILY DISCHARGE DATA

Station ..... River System..... Name of Stream.....
Date of Measurement..... Time from..... to.....
Gauge No..... Gauze Zero.....
Gauge Reading Started..... Completed..... Mean.....
Mean Water Level..... Common Width of Segments.....
Water Temperature Started..... Completed..... Mean Water Temperature.....
Type and No. of Current Meter..... Kind of Float.....
Mode of Suspension..... Length of Float Run.....
Equation.....
Date of Last Rating.....

Mark wind direction and velocity as shown in the diagram



RD (Reduced Distance) on Section (1)	Depth of Water (2)	Difference of Depth ΔD (3)	Wetted Perimeter of Segment $= \sqrt{(\text{Width of Segment})^2 + \Delta D^2}$ (4)	Time (Seconds) (5)	Meter (Revolutions) (6)	Velocity (7)	Drift (Metres) (8)	Velocity Corrected for Drift (9)	Angle of Current with Section (10)	Correction for Angle of Current (11)	Final Corrected Velocity (12)	Final Corrected Mean Velocity of a Vertical (13)	Water Depth × Corrected Velocity (col 2 × col 13) (14)	Discharge Correction + or − for Unequal Segments (15)	Remarks (16)
Total		Total wetted perimeter = P										Total			
Multiply by common width of segments												Multiply by common width of segments			
Product												Product			
Deduct (correction of area due to unequal segments)												Deduct total of col 15			
A = Area												Q = Discharge			

(Continued)

FORM 8 COMPOSITE FORM FOR RECORD OF DAILY DISCHARGE DATA — *Contd*

Surface Slope Observed

High Water Mark in the Upper Section	High Water Mark in the Lower Section	Difference of Levels Between the Two Sections	Length of Reach	Water Surface Slope = S
(1)	(2)	(3)	(4)	(5)

Calculation of Rugosity Coefficients

1) V = Mean Velocity = $\frac{Q}{A}$

2) R = Hydraulic Mean Depth = $\frac{A}{P}$

3) $c = \frac{V}{\sqrt{RS}}$

4) $N = \frac{R^{\frac{1}{6}}}{c}$

where 'c' shall be obtained from equation (3) above and not assumed.

*Notes — (1) Mean velocity will generally be velocity at 0·6 depth. If only mean velocity measurement is taken at each vertical, than col 7 will indicate 'mean velocity' and entries in col 12 and 13 will be identical. Where mean velocity is deduced from surface velocity, the coefficient employed should be noted in remarks column. Unless specially warranted, coefficient should be taken as 0·89.

(2) If no drift occurs, it has to be shown as 'NIL' in col 8; the column should never be left blank.

(3) When the number of meter observations taken at the same section is more than one, each observation of both time and revolutions shall be recorded in a separate line in col 5 and 6. When floats are used, time and surface velocity may be noted in col 5 and 7 respectively.

(4) In col 1 and 2, all the lines relating to one Station will be bracketed and RD on Section and water depth will be recorded once.

*These 'Notes' are applicable to the portion of Form 8 on P 8 only.