Indicator 9. Social Capital

This indicator is a late addition to the PEP. It was developed and tested in the field. Of all the indicator guides, this is by far the most open-ended. This is because the definition of social capital may vary considerably from programme to programme (various sorts of social capital will require different documentation methods).

TEAM MEMBERS (NUMBER AND SKILLS)

Social Scientist. The social scientist will need a clear understanding of the concept of social capital, in addition to knowledge about local social and governmental structures. He or she must also have the ability to conduct unstructured interviews.

NECESSARY TOOLS AND SUPPORT

1. No special tools.
2. A liaison from the partner NGO and or state department.

FREQUENCY OF USE

This indicator should be executed at the outset of the programme. There should be a gap of four to five years before it is used again. The delay between evaluations is quite long because social capital takes a long time to germinate and grow.

TIME REQUIRED TO USE INDICATOR

This cannot be specified. The evaluation team should spend whatever extra time that is available to investigate the existing level of social capital in the watershed.

SEQUENCE OF USE

Research for this indicator will be executed throughout the period of the evaluation.

SAMPLING

Begin with the selected villages, and gradually attempt to cover the whole watershed.

PROCEDURES AND METHODS

1. Even before arrival in the watershed, evaluators should begin to ask about local government structures, and watershed management institutions.
2. During the course of other discussions (e.g., water resource mappings, field visits to programme activities) the evaluators will inquire about water problems that local people have recently faced. What are the problems? How have they been dealt with? By whom?
3. Follow up carefully any potential leads. The details of complex social events can quickly get lost or change when they are retold a number of times. Locate the actual people involved and obtain the details from them.
4. Carefully note down the details of stories about local people working together to solve watershed problems.

DATA MATRIXES AND QUESTIONNAIRES

Questions must be based on the types of water-related problems that are encountered locally.

1. What problems related to water were encountered in the recent past?
2. How have people dealt with them?
3. Who were the active parties?

FINAL PRESENTATION OF DATA AND ANALYSIS

This is a qualitative variable, so there will be no tables, charts or graphs. Instead, the final report should contain detailed, descriptive accounts of the social capital uncovered in the watershed. This should comprise of general descriptions, as well as any case studies that may have been done.

3

HYDROLOGICAL MONITORING PROTOCOL: Manually Sampled Data

Purpose

These protocols are to be used by those who are manually collecting and processing data pertaining to hydrology such as rainfall, water level, stream discharge and sediment data in the Sediment Monitoring Stations.

There are various protocols that have been adopted and they have to be followed strictly in a standardized manner. These protocols describe in details the data sampling procedures and the data processing steps that are applicable to the local conditions.

Form M has been developed for the purpose of manual data sampling in the project stations.

A guide for the observer is also attached with the forms. With this unified data presentation form being used, the compilation and analysis of the data would be much easier and efficient.

There are basically four kinds of data collected manually at a typical station. These are:

Rainfall data :
Daily reading of the rainfall at 8.00 a.m.

Water level data:
During the monsoon period the stick gauge is to be read at half hourly interval. Water level data is later converted into stream discharge data by using rating formula.

Discharge data using float or current meter:
The objective is to make an equation relating water level to stream discharge so that the continuously observed water-level can be converted into continuous discharge data.

Sediment data:
Samples of water are collected at half hourly intervals during the monsoon period. The objective is similar to stream discharge data, i.e. relate sediment data to the water level so that continuously observed water level data can be converted to continuous sediment discharge data.

Data Sampling Procedures

The procedures adopted for measuring the above four basic data in this project are summarized herewith for reference:

RAINFALL MEASUREMENT

The measurement is to be taken every morning at exactly 8.00 a.m.. The reason for adopting this time is a matter of convenience but also as it is an universal standard for most meteorological data collection agencies.

Make sure that the watch used has been tuned to the standard time on radio or TV.

The jar at the bottom of the recorder is poured carefully without any spillage into a calibrated measuring cylinder. Let the cylinder rest on a solid and leveled platform. Read the lowest level of the water surface or meniscus at the eye level. Some cylinders can be read to the nearest 0.1 mm.

WATER-LEVEL MEASUREMENT

The water level is read from the stick gauge from time to time. During the monsoon period it is to be read at half hourly intervals.

The observer should read the stick gauge as close as possible to the water surface level.

If there are waves or fluctuations, try to read the maximum and the minimum at that instance and note down the mean water-level value.
For most stick gauge it is readable to the nearest 0.01 m or 1 cm.

DISCHARGE MEASUREMENT USING FLOAT

Since float is the predominant method used, only this discussed here.

In actual fact, this method should only be used when it is impractical to use a current meter, because of unsuitable velocities or depths or the presence of material in suspension, or when discharge measurement must be made in a very short time.

SURFACE FLOAT OR ROD FLOAT

A surface float is one whose depth of immersion is less than one- quarter the depth of water.

Surface float should not be used when there is a likelihood of it being affected by wind. In that case, a rod float whose depth of immersion exceeds one-quarter the depth of the water should be used.

SELECTION OF SECTIONS AND MEASURING STRETCH

Two cross-sections should be selected along a reach of straight channel. Choose the site upstream far away from the influence of a structure such as a weir.
The cross-sections should be spaced apart at a distance called the Measuring Stretch. The Measuring Stretch is best chosen such that travel time of the float is about 20 seconds (WMO standard). Try with a distance of about 50 meters and adjust if necessary.

MEASURING PROCEDURE

The float should be released far enough above the upper cross-section to attain a constant velocity before reaching the upper cross-section.

The stopwatch should be started at the time at which the float crosses the upper cross-section.

The observer may position himself at the lower cross-section and rely on his assistant positioned at the upper cross-section to signal the entry of the float, i.e. to start the stopwatch. Stop the stopwatch at the moment the float crosses the lower cross-section.

Ideally floats are uniformly distributed over the stream width. At least 3 floats over the width is recommended for a stream less than 50 meters in width.

COMPUTATION OF VELOCITY

The velocity of the float is equal to the distance between cross-sections, and measuring stretch, divided by the float travel time.

A correction coefficient of 0.86 is recommended by WMO to be applied to surface float velocity to obtain the mean current velocity in a particular panel.

COMPUTATION OF DISCHARGE

Discharge in each panel is computed by multiplying the average area of the panel by the mean velocity of flow in the panel. The total discharge is then equal to the sum of the discharge in the panels.

In the simple case of one float measurement, the discharge is hence estimated at 0.86 x float velocity x cross-sectional area.

MEASUREMENT OF SUSPENDED SEDIMENT DISCHARGE

Suspended-sediment, being kept aloft by the turbulence of flowing water, usually moves with similar velocity as the surrounding current.

In following sections of the text, unless specific reference is made, the word 'sediment' is meant to be suspended sediment.

SAMPLING INSTRUMENTS

Several types of suspended-sediment samplers are used, e.g. instantaneous, bottle, pumping, integrating, etc. The objective is, however, to obtain samples that are truly representative of the suspended-sediment discharge of the stream at the point of measurement.

MEASUREMENT PROCEDURE

Samples of suspended sediment in streams are taken at the discharge measuring cross-section.

Ideally a cross-section is divided into at least 3 panels of about equal discharge and one sample is taken from each of the panels.

Due to practical constraints in the project, only one sample per cross-section has been used.

Try not to disturb the flow while lowering the sampler into the stream.

Write down on the bottle the sample number so that it will be registered on the form sheet in relation to date, time, stick gauge reading and other reading taken at the same moment.

DETERMINATION OF SEDIMENT CONCENTRATION

To determine the sediment concentration, a laboratory or site equipped with the necessary laboratory tools is required.

The sample is processed in accordance with the following procedures:

1. For each water sample taken, pre-weigh a filter paper, a beaker and a petrifying dish. Label them with sample no. The filter paper is also given a number.

2. The water sample collected is first passed through a sieve of no.BSS-100[IMM70] or commonly called the 100 mesh sieve. Keep the filtrate in an enamel bucket for later use.

3. The sediment after thorough washing and retained on the sieve is placed in the pre-weighted dish and dried in an oven or sun to remove moisture.

4. Weigh the dish with the coarse sediment and hence obtain the weight of the sediment by subtracting the weight of the dish. The weight is measurable to the nearest 0.001 g.

5. The filtrate obtained in step 2 in the enamel bucket is topped up with distilled water to make a depth of 10 cm in the bucket.

6. The contents of filtrate and distilled water is stirred with mechanical stirrer or by hand with the help of a glass rod fitted with a rubber tube in a "8" wise direction for a few seconds to ensure homogenous distribution. It is allowed to stand for 30 seconds before proceeding.

7. After about 30 seconds, the supernatant or the water floating above is poured off slowly into a large bucket as residual which is to be kept for later stage.

8. The process of separation of medium size sediment by pouring as in step 6 and followed by filling bucket to the 10 cm height with distilled water as step 5 above is repeated several times until the supernatant is rendered clear.

9. The medium size sediment settled in the bottom of the enamel bucket is now transferred into the weighted beaker and is dried in an oven or sun.

10. The weight of the beaker with the medium sediment is weighted, hence giving the weight of medium sediment after the subtraction of the weight of the beaker as obtained in step 1 above. The weight of medium sediment is also expressed in g.

11. The residual as obtained in step 6 above is now filtered through the pre-weighted filter placed on a funnel.

12. After filtering has stopped, take out the wet filter paper together with the fine sediment filtered on top and place it in a glass dish. The whole content is dried under the sun on a clean platform.

13. Weight of the dried filter paper with fine sediment is measured. The weight of the fine sediment is hence obtained by subtracting the weight of the filter paper as obtained in step 1.
The weight is expected to be expressed to the nearest 0.001 g if electronic balance is available.

14. The total sediment weight (say y g) as obtained in a water sample with x liter of sample volume is the sum of the weight of coarse, medium and fine sediment as obtained in steps 3, 9 and 12 above.

15. The concentration of suspended sediment is expressed in g/m3 (WMO standard). For this case , the concentration is :

$$Sc = \frac{y}{x} \left(\frac{g}{l}\right)$$

with
y . . . total sediment weight (y)
x . . . sample volume (l)

$$Sc = 1000 \frac{y}{x} \left(\frac{g}{m^3}\right)$$

SEDIMENT YIELD CALCULATION
To obtain Sediment Production (SPR) rate in hectare-meter per 100 km2. (MOA standard), the calculation is as follows:

Using the above example of suspended sediment concentration of y/x *(g/l)*, assuming density of sediment is 1.4 g/cm^3, the suspended sediment yield is:

$$SY = (y/x) \; / \; (1.4) \cdot 10^{-7} \quad ha \cdot m \; / \; m^3$$

and if flow discharge is measured from the watershed is Q (m^3) over a specified time period with that suspended sediment yield, then the suspended sediment yield in that period is

$$SY = Q \cdot \frac{y}{x} \; / \; (1.4) \cdot 10^{-7} \quad \textit{ha.m per time period}$$

and if the above suspended sediment is produced from a watershed has an area of A hectare, the suspended sediment production rate is

$$SPR = (Q/A) \cdot (y/x) \; / \; (1.4) \cdot 10^{-3} \quad \textit{ha.m per time period}$$

If one assumes that bed load is Z percent of the suspended load, then the Total Sediment Yield (TSY) is taken as

$$TSY = [(1+(Z/100)) \cdot (Q/A) \cdot (y/x) \; / \; (1.4)] \cdot 10^{-3} \quad \textit{ha.m per time period}$$

Evaluation of Form M

This is a guide for the use of evaluating, processing and storage of data collected in Form M.

STEPS
Five steps are established as below:

1. Checking
Checking against any obvious error such as blanks not being filled, impossible values, impossible accuracy, etc.

2. Correction
Make correction for any error which is obviously wrong and can be corrected based on some general guide as explained later.

3. Data Entry into Computer
Keying data into computer for storage.

4.Retrieve Data for Comparison with Automatically Sampled Data
Retrieve Data into certain formats which are comparable to the results from recording gauge. If correlation is good, then the two series of data can be supplementing each other should any of the one series has short broken recording.

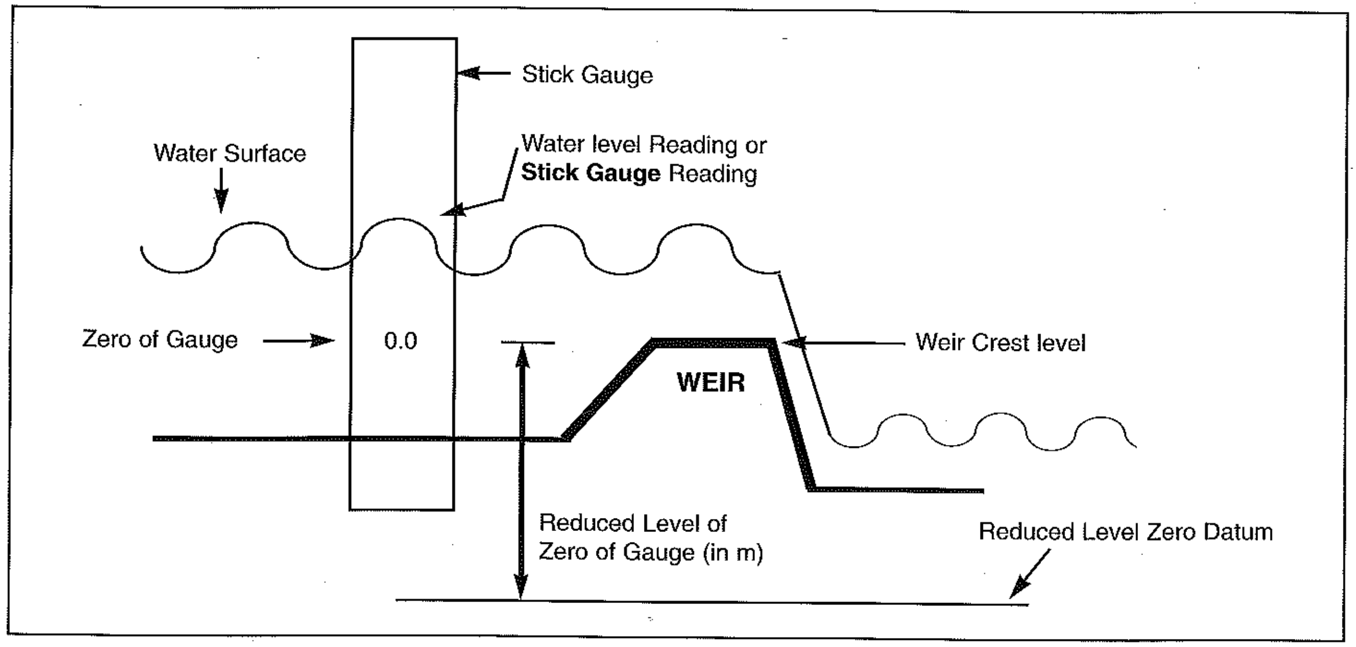
5. Print out Results
Print results and analysis in presentation formats.

CHECKING AND CORRECTION
HEADERS
First make sure that the observer/ analyst has filled the Header Section completely. If there is information that is not applicable or not available, the observer should put down a cross "x" in the blank provided.

However, information on "Station" , "State", "Year"
and "Sample Volume" must not be skipped under any circumstances.

"Float Measuring Stretch" has been described earlier.
"Zero of Gauge", "Weir Crest Level" and "Weir Width" have to be measured or surveyed.

The following figure helps to define the parameters regarding weir and stick gauge.



"Rating or Weir Formula"
Ideally the weir or controlled section should be rated using current meter measurement at various stage height.

Note that the zero of gauge is normally set to the weir crest level and the stick gauge has to be located at about 3 times the maximum water head expected over the weir(WMO).

Each of the columns in Form M needs to be checked. The following is a set of guideline for checking and correcting the data in the columns.

COLUMNS
Things to watch out and Correction Measures

Date:
Make sure no measurement should be recorded without a date.

Time
Make sure that the standard notation for hour is followed. No error such as 65 minute should be allowed.

Stick Gauge Reading
Most stick gauge is readable only to the accuracy of nearest centimeter, i.e. the accuracy of +/- 0.01 meter (2 decimals). Any value higher than 2 decimal places can be fictitious and have to be removed.

Bottle Sample No.
Make sure that the observers have the habit of noting down the number.

Float Travel Time
If travel time is greater than 40 seconds, note down in the comments space that the stretch is to be adjusted shorter in-order that the distance for the float to travel is around 20 seconds (WMO standard).

Rainfall Measured
Most measuring cylinder or jar is only readable to the accuracy of +/- 0.1 mm. Any accuracy higher than this is not possible.

THINGS TO WATCH OUT FOR AND CORRECTION MEASURES (COLUMN A TO I)
Weight of Coarse Sediment
Watch out for unreasonable figures, e.g. 50.0g

Weight Of Medium Sediment
Also watch out for unreasonable figures, e.g. 20.0.g

Filter Paper Serial No.
Serial number should be written down to avoid confusion.

Weight of Filter Paper Only
Check for accuracy to the nearest 0.001 g. for electronic balance measurement.

Weight of Filter Paper + Sediment
Check for accuracy to the nearest 0.001 g. for electronic balance measurement.

Weight of Fine Sediment
Check for accuracy to the nearest 0.001 g for electronic balance measurement. Make sure the subtraction of Column D from Column E is correct.

Total Weight of Sediment
Make sure that the sum of Columns A, B and F is correct.

DISCHARGE BY FLOAT
Area
Check randomly the area used with the station's stage-area table. If one is found to be incorrect, check the rest in the form.
Velocity V
Check the calculation of Float Measured Stretch (Header 5) divided by Float Travel Time (Column 5).

Discharge VxAx 0.86
Check randomly the results of the multiplication. Check every other multiplication if the randomly chosen one is wrong.

DISCHARGE BY RATING
Head
Check the derivation of Head from Gauge Reading (Column 3). If weir is available, check the subtraction of the weir crest level from the Gauge Reading in the case where the zero of gauge is not set to the weir crest level. If the discharge measurement site is a natural channel, check that the transfer of data from Column 3 is correct.

Discharge Q
Check the randomly one result of applying the rating formula. Check the other results only if the randomly chosen one is wrong.

DATA SUBMISSION
After all the above has been executed and the data has been checked, it is necessary to submit the first carbon copy of the data derived from manual collection to the Ministry of Agriculture at the end of each year.

Hydrological and Sediment Data Sampling Form M

Station : HARSOL State : Maharashtra Year : 1998-99 Sample Volume (l) : 500ml.	Float Measuring Stretch 50mt. Reduced Level of Zero of Gauge (m) : Rating or Weir Formula :	Weir Crest Level (m) : Weir Width (m) : Observer's Name : A J Deore Analyst's Name : R. D. Gunjal.	**Hydrological & Sediment Data** *Form H1/92* Indo-German Bilateral Project-'Watershed Management'

1	2		3	4	5	6	A	B	C	D	E	F	G	H			I	
Date	Time		Stick Gauge Reading	Bottle Sample No.	Float Travel Time	Rainfall Measured	Weight of Coarse Sediment	Weight of Medium Sediment	Filter Paper Serial No.	Weight of Filter Paper Only	Weight of Filter Paper + Sediment	Weight of Fine Sediment	Total Weight Sediment	Discharge by Float			Discharge by Rating	
	Hour	Min	(m)		(s)	(mm)	(g)	(g)		(g)	(g)	(g)	(g)	Area (m²)	V (m/s)	V x A x 0.86 (m³/s)	Head (m)	Q (m³/s)
13/6/98	8	00	–	–	–	11.8	–	–	–	–	–	–	–	–	–	–		
	11	00	0.30	12	168	–	–	–	12	1.200	1.716	0.516	0.516	2.360	0.29	0.588		
	12	00	0.40	13	190	–	–	–	13	1.196	1.755	0.559	0.559	2.636	0.26	0.589		
	13	00	0.36	14	160	–	–	–	14	1.238	2.119	0.881	0.881	3.116	0.31	0.830		
	14	00	0.30	15	174	–	–	–	15	1.202	2.301	1.099	1.099	2.360	0.28	0.568		
	15	00	0.30	16	178	–	–	–	16	1.260	2.441	1.181	1.181	2.360	0.28	0.568		
14/6/98	8	00	–	–	–	2.8	–	–	–	–	–	–	–	–	–	–		
15/6/98	8	00	–	–	–	2.7	–	–	–	–	–	–	–	–	–	–		
							–	–										
16/6/98	8	00	~~8-00~~	–	–	20.5	–	–	–	–	–	–	–	–	–	–		
	10	00	1.70	17	10	–	–	–	17	1.196	2.925	1.729	1.729	31.100	5.00	133.73		
	11	00	1.80	18	10	–	–	–	18	1.193	2.726	1.533	1.533	35.148	5.00	151.13		
	12	00	1.00	19	39	–	–	–	19	1.209	2.806	1.597	1.597	13.204	1.28	14.534		
	13	00	0.94	20	45	–	–	–	20	1.188	2.337	1.149	1.149	12.056	1.11	11.508		
	14	00	0.60	21	50	–	–	–	21	1.206	1.924	0.718	0.718	6.392	1.00	5.497		
	15	00	0.50	22	70	–	–	–	22	1.220	2.185	0.965	0.965	4.980	0.71	3.040		

Remarks by Observer/~~Analyst~~ : (A J Deore)

Checked by : R. D. GUNJAL, AGRIL. OFFICER, S.M.S. LABORATORY (IGBP), NASHIK-422 002
Date :

Comments :

Computerised by :
Date :

Guide for using Form M

GENERAL
There are three basic sections in this form: the top section called the "Headers", the middle section of "Columns" and the bottom section of "Footers".

I. HEADERS
This section must be filled as far as possible as the information needed here is vital.

a. Station Name:
This refers to the name of the station or sediment monitoring station as given by the respective operating authority. eg. Bisalwas.

b. State:
The state in which the station is located, e.g. Rajasthan.

c. Year:
The year in which the sheet of data is taken.

d. Sample Volume (l):
The volume in liter(s) of the bottle that is used for sampling of water for suspended sediment analysis.

e. Float Measurement Stretch (m):
The distance from the starting point to the ending point where the travel time of a float is to be timed by stopwatch. If no observation is made on float, note down " x ".

f. Reduced Level of Zero of Gauge:
The reduced level of the zero point of the stick gauge and is normally determined by precision level survey. If no information is available, note down " x ".

g. Rating or Weir Formula:
The formula that is considered to be applicable for the particular section of water level observation. It can be in the form of

$$Q = u\ b\ (2g)^{1/2}\ h^{3/2}$$

in the case of broad crest weir whereby b is the width of weir, u is discharge coefficient based on weir height, the form of weir crest and the measured weir head h, or

$$Q = a\ (H - b)^{c}$$

in the case of a trapezoidal section whereby a, b and c are the coefficient derived from the fitting of Q versus stage height H.
A perfect broad-crested weir has the rating of:

$$Q = 1.84\ u\ h^{3/2}$$

If no rating or weir formula is used, note down "x".

h. Weir Crest Level (m):
The level of the top of the weir as read from the stick gauge in meter. Note down " x " if there is no weir at the station.

i. Weir Width (m):
The effective width of the weir measured in meter from bank to bank discounting the width of any structural element that is obstructing to weir flow above the crest. Note down " x " if there is no weir at the station.

j. Observer's Name:
Name of the person who is responsible for making entries from Column 1 to Column 6.

k. Analyst's Name:
Name of the person who is responsible for making entries from Column A to Column I.

II. COLUMNS
The columns are numbered from 1 to 6 and A to I are to be filled by the observers and/or silt analyst while they are taking readings and samples in the field .

Columns A to I are for the use of the silt analyst or the officer in the laboratory.

1. Date:
The date of making the observation, e.g. 23/8 for the 23rd day of August.

2. Time:
Hour: The hour in the day of making observation, for example:
08 for 8.00 a.m.
12 for noon
14 for 2.30 p.m.
20 for 8.35 p.m.

Min: †The minute of the hour in which the observation is made, for example:
05 for 2.05 p.m.
45 for 8.45 a.m.

3. Gauge Reading (m):
The water level or stage as read from the stick gauge or staff expressed in meter, e.g. 3.35 with accuracy of 1 cm.

4. Bottle Sample No.:
Every water sample taken up is to be labeled with a number on the bottle so that it can be differentiated up to the time of analysis in the laboratory. It is recommended to start labeling " 1 " on the first sample in any year and proceeds with "2", "3", ...etc. for

subsequent samples taken during the year.

5. Float Travel Time (s):
The time taken in seconds for the surface float to travel over a fixed distance or "Measuring Stretch". Stopwatch is recommended for this measurement.

6. Rainfall Measured (mm):
The rainfall as measured at time indicated. It is recommended to take daily reading at 08.00 in the morning.

If no rain is observed, note " 0.0 " in the column provided.

If no observer or his deputy is able to make any observation for any day due to very special event, note down " x " in this column.

A. Weight of Coarse Sediment (g):
Weight measured in gram (g) of suspended particles above 0.2 mm in diameter collected in one sample bottle.

B. Weight of Medium Sediment (g):
Weight measured in grams of suspended particles of size between 0.075 to 0.20 mm in diameter collected in one sample bottle.

C. Filter Paper Serial No.
A serial number is to be placed on each filter before being used in order to avoid confusion. It is recommended to start from 1 (one) for the first sample in the year and proceed by one for each subsequent sample in the year.

D. Weight of Filter Paper Only:
This refers to the weight of the filter paper in gram. It is weighted before being used.

E. Weight of Filter Paper + Sediment (g):
The total weight of filter paper after filtering for fine sediment and dried.

F. Weight of Fine Sediment (g):
This is the calculated weight of fine sediment in one sample bottle, effectively obtained from Column E minus Column F.

G. Total Weight of Sediment (g):
This is the sum of the weight of coarse, medium and fine sediment and is derived by from adding up columns A, B, and F.

H. Discharge by Float:
This is provided for the calculation of flow discharge if float velocity is measured.

Area: The area refers to the area under the present flow stage and it should be obtained from water-level-area table prepared after each cross-sectional survey.

V : Float Velocity obtainable from dividing the Float Measuring Stretch (Header 5) by the Float Travel Time (Column 5).

V • A • 0.86 : Multiplying Float Velocity, Area and the surface float correction factor of 0.86 to obtain the estimated discharge.

I. Discharge by Rating
This is provided for the calculation of discharge using known rating equation, either a known weir formula or stage-discharge formula as stated in Header g.

Head (m): In the case of weir, this should be the Stick Gauging Reading (Column 3) minus the Weir Crest Level (Header h). Normally the Zero of the Gauge should be set to the same as the Weir Crest Level so that the Head is the same as Stick Gauge Reading. In the case of a stage-discharge formula for trapezoidal section this is the Stick Gauge Reading (Column 3).

Q (m3/s): Discharge derived after applying the Stick Gauge Reading (Column 3) into the formula. Note that each Stick Gauge Reading will have a corresponding discharge value.

III. FOOTER
Remarks by Observer / Analyst:
This is to be filled in by the Observer/Analyst on any special event encountered, e.g. "Flood damaged the weir crest", "Stick Gauge No.1 is lost".

Checked By / Comments / Date:
This is reserved for the person checking the filled form submitted by the Observer / Analyst to place any comment on the data, e.g. "Minute Column not filled", "Observer need to be informed about..". Date of the checking has to be noted.

Computerized By / Date:
This is reserved for the endorsement by the person who has keyed the data in this form into computer for storage. Date of computer entry needs to be noted.

4

HYDROLOGICAL MONITORING PROTOCOL:
Automatically Sampled Data

A. Purpose

These procedures are intended as a practicing guide for those engineers and officers who are in charge of Sediment Monitoring Stations. They are technically responsible for the installation of automatic sampling equipment, changing of recorder charts, maintaining of recorders, data loggers, batteries, solar panels, etc, and the processing of data retrieved from the field from these equipments.

B. Data Mediums

There are two mediums of data output obtainable from the automatic hydrological equipment:
Recorder charts
Data logger files
These output must be carefully prepared right from the beginning and processed in accordance with the procedures laid down below.

TYPES OF RECORDER CHARTS
Two types of charts are commonly found:
rainfall charts
water-level charts

SECTIONS ON DATA MEDIUMS
Section C to Section H are concerning recorder charts
Section I is dealing with data logger files

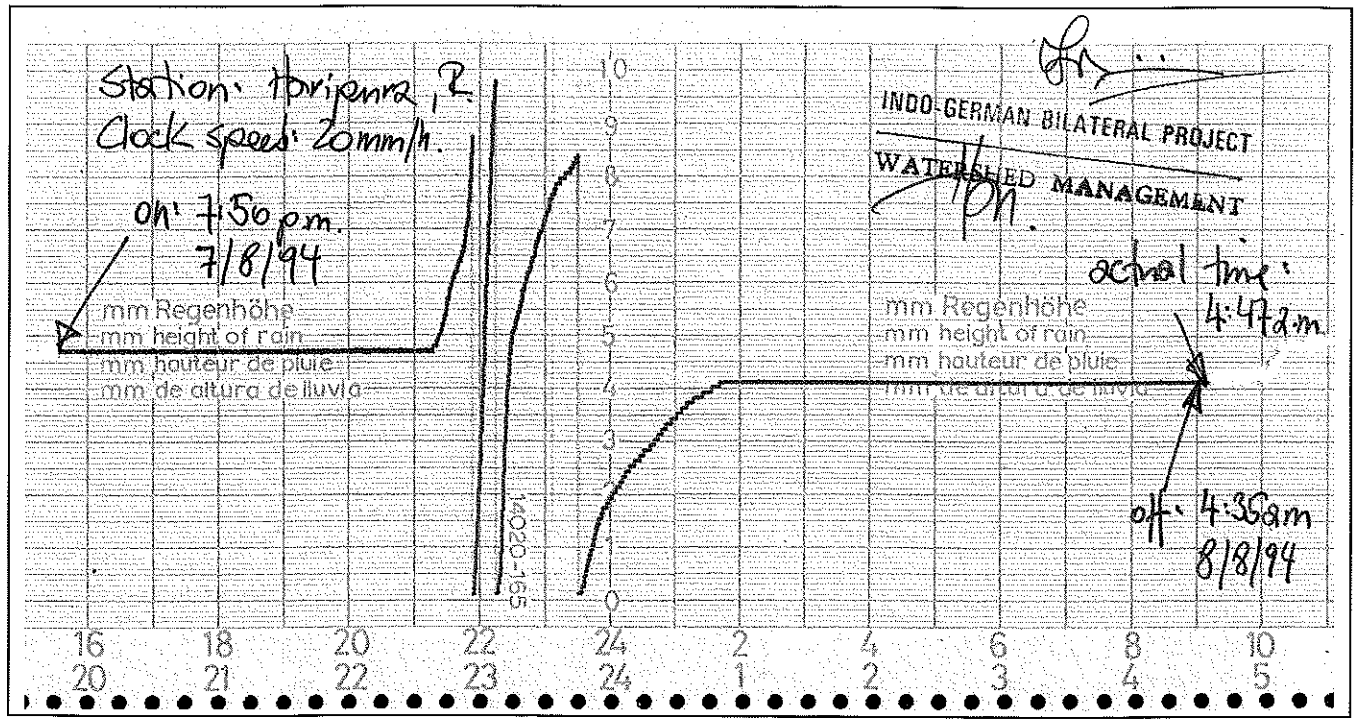
C. Things to Do in the Field

The first step begin with the changing of charts in the field which will affect the most important element of chart data. This step also involves the writing down of station name, date, time and values.

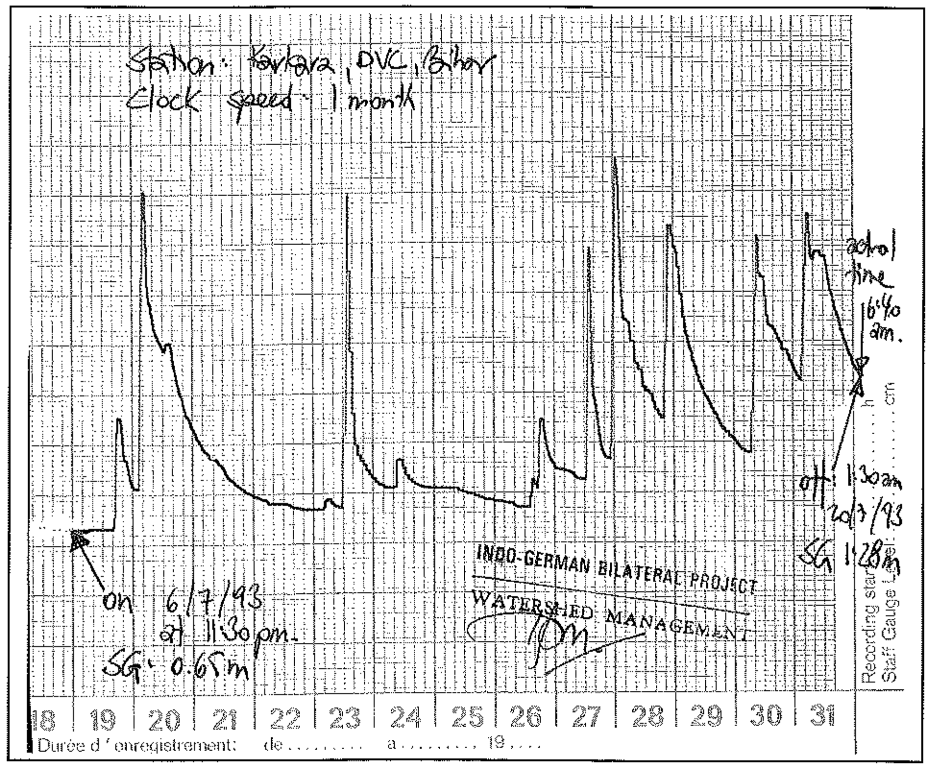
RAINFALL CHART
When installing the rainfall chart, write down near the beginning of the chart the "On Date and Time" to the nearest minute. Use an arrow to indicate the position of the chart for this "On Date and Time". Note down the clock speed, e.g. 10mm/minute, 20mm/minute.

When taking the chart off later, do write down the "Off Date and Time" near the end of the used chart. Use another arrow to indicate the position of the chart for the "Off Date and Time". The figure on the following page shows an example of doing these.

EXAMPLE OF A PROPERLY INSTALLED RAINFALL CHART



EXAMPLE OF A PROPERLY INSTALLED WATER-LEVEL CHART



WATER-LEVEL CHART

When installing the water-level chart, write down near the beginning of the chart the “On Date and Time” to the nearest minute. Also, read the stick gauge at that moment and write down the value on the chart, e.g. SG 2.38m.

The clock speed, on the basis of two weeks or month, should be noted down as well. Use an arrow to indicate the position of the chart that has the “On Date and Time” and the stick gauge value.

When taking off the chart later, do write down the “Off Date and Time” together with the stick gauge value near the end of the used chart. Again use another arrow to mark this position. The figure on the opposite page shows an example of the marking of water-level chart.

CLOCK SPEED

To save charts, it is advisable to change the clock speed of;

rainfall:
- for monsoon period : 20mm/minute
- for other period : 10mm/minute

water-level:
- for monsoon period : 2 weeks
- for other period : 1 month

Due to this differential speed arrangement, it is necessary to write down the clock speed at the beginning of each chart period for the convenience of data abstraction later.

TRANSPORTING CHARTS

Transportation of charts from the field back to the office must be handled with care since loss of a single chart can mean a break in a long term series. If one manual or logger data happens to be unavailable, months of effort can go down the drain. Store the charts in safe places at all time.

D. Things to Do in the Office

GROUPING OF CHARTS

There may be a number of stations that you are handling, the charts are best classified and serially stacked according to the time periods covered by the charts.

ABSTRACTION OF CHARTS

All the charts are to be abstracted according to the procedures as in the Section E if it is a rainfall chart and in Section F if it is a water-level chart.

COMPARISON WITH MANUAL DATA

After abstraction of automatic recorder data, it has to be compared with the manually observed data. This is explained in Section G.

E. Abstraction of Rainfall Charts

MARKING DATE

Mark the date divide at 08:00 hours and have the date in the form of day/month written down on the chart, e.g. 3/8 for the period starting at 08:00 hour on 3rd of August until 08:00 hour on 4th of August.

The reason for dividing at 08:00 to 08:00 is to enable comparison later of the abstracted data with that of the manually recorded data.

CHECK AND ADJUST TIMING

Compare the date and time as read from the end of the graph marked by the recorder pen with that of the time written down by the observer at the moment when the chart was taken off from the recorder, i.e. Off Date and Time.
If both time readings are not the same, then the recorder is either running too fast or too slow. Write down the difference in the Form I "Station Inspection" so that any officer making the next trip to the station will be reminded to make some adjustment to the clock.

Make manual adjustment of the time scale if the difference is great. For example, if the clock is found to be running too fast by 3 hours over a period of 30 days, each daily interval on the time axis will have to be scaled up by the length of 3 hours divided by 30.

The times noted down when changing charts are assumed to be correct. Once the charts are checked and marked, they are ready to be abstracted.

DAILY ABSTRACTION

Abstract the total amount of rain over the defined day of 08:00 to 08:00 and write down in the respective cell provided for each day in the Form H2 "Daily Rainfall Abstraction".

For example, the rainfall amount over the period starting at 08:00 hour on 3rd of August until 08:00 hour on 4th of August is 10.5 mm. The value 10.5 is written on the cell reserved for 3rd of August.

SIMPLE ANALYSIS

Calculate the sum of the rainfall for one month and place it in the "SUM" cells near the bottom of the form.

Look for the highest value in each month and place it in the "MAX" cells at the bottom of the form.

Sum up all the monthly values and enter it in the box "ANNUAL TOTAL" at the bottom of the form.

The highest in the "MAX" row is place in the box "ANNUAL MAX" at the bottom of the form.

STORAGE OF CHART

After the calculations have been carried out for the charts, store them away in a safe place, classified according to the station and year. These charts may be referred to from time to time if necessary. Take care to protect these from insects or mice.

F. Abstraction of Water-level Charts

MARKING DATE

Mark the date divide at 24:00 hours and have the date in the form of day/month written down, e.g.11/8 for the period of 00:00 hour on 11th of August to the 24:00 hour on 11th of August.

CHECK AND ADJUST TIMING

Compare the date and time as read from the end of the graph marked by the recorder pen with that of the time written down by the observer at the moment when the chart was taken off from the recorder, i.e. Off Date and Time.

If both time readings are not the same, then the recorder is either running too fast or too slow. Write down the difference in the form I so that during the next trip to the station, the clock can be suitably adjusted.

Make manual adjustment of the time scale if the difference is great. The observer's time noted down is assumed to be the correct timing.
Once the charts are checked and marked, they are ready to be abstracted.

MAXIMUM ABSTRACTION

The charts are scanned through for the peaks levels. For every peak level encountered, note down the date, time and water-level value on the form H3 "Peak Water-Level Abstraction".

ANNUAL EXTREMES

After abstracting the peak levels of all the charts covering the period of a year has been completed, the top three extremes or highest in the year is entered in the space provided as Annual Extreme Water-level at the bottom of the form. These will later be converted into Annual Extreme Discharge based on rating formula applicable for the period.

STORAGE OF CHART

After the above routines have been carried out for the charts, store them away in a safe place classified according to the station and year. These charts may be referred to from time to time if necessary. Take care to protect these from insects or mice.

G. Comparison with Manual Data

ABSTRACTED RAINFALL DATA

The rainfall data abstracted according to the above procedures can be further checked with that of rainfall measured manually.

If some serious differences are found, there are two possibilities, either the observer is not reliable or the recorder is not functioning properly.

One quick way of checking is to compare the total amount of rainfall in a month. If the observer is reliable, the amount recorded may show consistently slightly higher values (by 3 % to 5 %). This is due to the systematic error of the tipping bucket system in the automatic recorder.

If the observer is considered to be reliable, based on field inspection or other means, the manual rainfall record can be more accurate although it is only at daily intervals.

If the monthly rainfall sums obtained from the observer differ greatly from that of the recorder and the daily readings also show a similar trend, then it is likely that the observer is not reliable. Test the observer in the next trip on the reading of some simulated rainfall. If the observer fails the test then the period of daily data from the observer has to be reexamined and marked "unreliable" on form H2.

ABSTRACTED WATER-LEVEL

Data from the form M can be compared with that of abstracted water-level extremes. Compare peak levels at the same timing with the manually recorded levels. Although the timing may not exactly coincide, the order of magnitude should not be far off. If the order of magnitude is far out, the observer has to be tested in the next trip to read the stick gauge to find out whether he is reliable.

H. Digitising of Charts

A computer program package which commands a digitising tablet can be used in picking up digital data from the recorder charts at a fast speed.

Three possible situations that the digitising program will be used:
a. charts from stations that does not have any data logger installed;
b. charts from stations that have loggers installed but the loggers failed or malfunctioned;
c. charts from stations that have recorders installed well before any logger is installed, i.e. the charts that were produced before the project started.

It is vital that all these chartsbe kept in safe places so that they will be available in good condition by the time digitising is introduced.

I. Stations with Loggers

The data logger must be carefully checked and data retrieved every time a field trip is undertaken to any station equipped with a logger.

Make note on details about the files transferred in the space provided for this purpose in No. 9 on "Data Logger" of form I. The diskettes that you used for storing the data files should be numbered to avoid confusion later.

Take good care of the diskettes when transporting them to the office. Avoid placing them near to any strong magnetic field or heat source.

SUBMISSION OF DATA

After each monsoon period, the followings files must be properly named and sent on 5 1/4" diskette to the Ministry of Agriculture for compilation and further analysis:
- all original data logger files
- all processed data files

Notify the file names on each diskette with a directory listing of each of the diskettes.
The output to printer on the followings are also to be sent:
- daily rainfall sheet
- daily water-level sheet

Daily Rainfall Abstraction Form H2

Station : ARKI KHAD	DAILY RAINFALL ABSTRACTION
State : HIMACHAL PRADESH	FORM H2 / 92
Year : 1997	Indo-German Bilateral Project - 'Watershed Management'

DAY	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
1	0.0	0.0	0.0	9.7	0.0	0.0	0.0	8.7	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	5.3	3.4	0.0	0.0	21.5	0.0	0.0	0.0	0.0
3	0.0	8.0	0.0	1.1	8.6	1.0	0.0	91.5	2.9	14.4	0.0	0.0
4	0.0	9.9	0.0	17.3	7.0	1.5	0.0	1.1	0.0	0.0	3.9	0.0
5	0.0	0.0	0.0	1.6	11.6	3.4	0.0	0.0	0.0	18.0	0.8	0.0
6	0.0	0.0	0.0	0.7	13.6	4.5	5.4	0.9	8.8	8.3	0.0	0.0
7	0.0	0.0	0.0	0.0	7.9	0.0	6.1	8.0	19.7	0.0	4.3	0.0
8	0.0	0.0	0.0	11.1	24.0	0.0	8.6	10.0	7.2	0.0	0.0	0.0
9	0.0	1.8	0.0	12.1	0.0	12.6	10.5	0.5	0.0	0.0	0.0	21.1
10	0.0	2.3	0.0	0.0	0.0	10.0	157.7	18.5	0.0	0.0	17.4	13.6
11	0.0	0.9	0.0	0.0	0.0	0.0	28.5	25.9	2.4	0.0	4.2	0.0
12	0.0	0.0	0.0	5.4	0.0	0.0	0.0	66.1	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.1	10.5	0.0	0.0	0.0
14	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	11.4	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0
16	0.0	0.0	8.2	0.0	0.0	2.2	5.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	11.5	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0
19	2.5	0.0	0.0	0.0	0.0	13.6	0.0	0.0	0.7	0.0	0.0	0.0
20	40.2	0.0	0.0	0.0	0.0	9.9	0.0	1.9	0.0	3.5	5.1	0.0
21	5.3	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	5.1	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	8.1	0.5	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	10.2	0.0	6.0	5.0	0.0	0.0	6.1	0.0
26	0.0	0.0	0.0	0.0	0.0	0.0	0.5	10.9	0.0	4.3	10.3	0.0
27	0.0	0.0	0.0	0.0	0.0	3.9	0.0	1.4	0.0	0.0	4.8	0.0
28	0.0	0.0	0.0	28.0	0.0	4.0	6.3	14.2	0.0	0.0	0.0	0.0
29	0.0	—	8.5	0.0	0.0	0.0	3.6	1.7	13.1	0.0	0.0	1.5
30	0.0		9.9	0.0	1.5	0.0	0.0	3.5	7.4	0.0	0.0	24.7
31	0.0		0.0		0.0		4.7	0.0		3.4		0.0
SUM	48.0	22.9	38.1	115.7	87.8	75.9	245.5	326.8	78.2	57.0	58.6	60.9
MAX	40.2	9.9	11.5	28.0	24.0	13.6	157.7	91.5	19.7	18.0	17.4	24.7

ANNUAL TOTAL : 1215.4 | ANNUAL MAX : 157.7 | ABSTRACTED BY : (LAL SINGH) | CHECKED BY : (KULBIR SINGH)

Peak Water Level Abstraction Form H3

PEAK WATER LEVEL ABSTRACTION

FORM H3 / 92

INDO-GERMAN BILATERAL PROJECT

'WATERSHED MANAGEMENT'

Station : Khadakohal

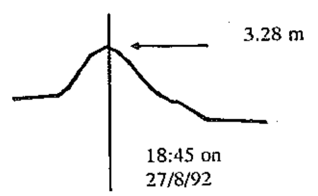
State : Maharashtra

Year : 1998

Abstracted By : V. B. Patil

Brief Instructions :

1. The water-level on chart datum, date and time of each occurence are to be written down. For example :



the peak event is to be recorded as :
27/8/92 18 45 3.28

2. The peak water-level events in one year are ranked and the three highest peak events are to be listed in the space below as Annual Extremes.

Rank	Date and Time	Stick Gauge Level	Discharge
1st	17/09/98 6.00	2.00	60.871
2nd	16/09/98 14.00	1.54	54.567
3rd	04/11/98 15.00	1.50	32.221

Date	Time		Stick Gauge Level (m)	Reduced Level (m)	
16/06/98	13	00	0.80	45.00	
07/07/98	18	00	1.02	45.22	
—	19	00	1.36	45.56	
08/07/98	9	00	1.40	45.60	
—	10	00	1.38	45.58	
16/07/98	15	00	1.02	45.22	
—	16	00	0.98	45.18	
17/07/98	15	00	0.90	45.10	
08/08/98	15	00	1.00	45.20	
—	17	00	0.86	45.06	
09/08/98	6	00	1.00	45.20	
—	7	00	0.96	45.16	
—	16	00	0.88	45.08	
11/08/98	19	00	0.90	45.10	
25/08/98	15	00	0.86	45.06	
30/08/98	13	00	0.82	45.02	
03/09/98	19	00	1.02	45.22	
16/09/98	6	00	1.42	45.62	
—	14	00	1.54	45.74	II
—	15	00	1.32	45.52	
17/09/98	6	00	2.00	46.20	I
—	7	00	1.56	45.76	
4/11/98	15	00	1.50	45.68	III
—	16	00	1.00	45.18	

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