Stream Channel Study

Version 2.3

A. Planning and Preparation

Module

Managing River Environment

Enquiry Question

Hypothesis 1 : ***The lower the river course, the larger the stream discharge.***

Hypothesis 2 : ***The lower the river course, the smaller the channel friction.***

Hypothesis 2 : ***The lower the river course, the smaller the channel gradient.***

Key Concepts

River courses	River energy	Stream discharge	River velocity	Channel gradient
Channel shape	Wetted perimeter	Hydraulic radius	Channel efficiency	Pebbles roundness

Scope of the Study

Tai Tso Stream in Tai Mo Shan

Time of the Study

Date:_____ Season:_____ Rainfall in the past 24 hours:_____

Think About

1. Is this an appropriate time for fieldwork? Explain your answer.

2. List the safety risks when conducting stream channel fieldwork.

Field Work Plan

At each site (A & B), choose a straight reach of stream to conduct this field study. Avoid, as far as possible, pools or eddies.

Channel Shape

Use measuring tapes to measure the width, depth and wetted perimeter of the stream shown in Fig.1, and record the data in Data Recording Sheet.

1. Hold the tape taut across the stream (perpendicular to the river bank), set up a transect and measure the channel width.
2. Measure the water depth at 10cm intervals across the transect, and ensure it is measured vertically on the river bed and not affected by water splash. In case of encountering any boulder, measure the depth of water upstream or downstream of the boulder.
3. At the river bank, starting from the point of measuring channel width, carefully lay a measuring tape along wetted perimeter, till you reach another side of the river.

Roundness of Pebbles

1. Collect pebble samples (diameter ranging from 4 mm to 64 mm).
2. Measure its longest diameter (*L*) with caliper, shown in Fig.2.
3. Measure the radius of a pebble's sharpest angle (*r*) by the Cailleux Roundness Chart
4. Calculate the Cailleux Roundness Index (R).
5. Continue to measure the roundness index of the specified number of pebble samples, calculate the average roundness, record the data in Data Recording Sheet.

Cailleux Roundness Index (R) = $\frac{2r}{L}$ x 1,000

Channel Gradient

Use an abney level, ranging poles, level meters and measuring tape to measure channel gradient, shown in Fig.3.

1. Two groups wading into the stream and stand 10 m apart. Each group holds a ranging pole perpendicularly to the river bed with a level meter.
2. The person upstream can hold the abney level against the first ranging pole at a suitable height, and sight the corresponding point on the second pole. Read the angle of depression.
3. Then take the angle of elevation from the downstream pole towards the first pole. Calculate the average gradient and enter all data in Data Recording Sheet.

River Velocity

1. Along the transect, measure the river velocity for 3 times, by a stream flow meter, or a timer with a float.
2. Calculate the average velocity and discharge of the stream, and enter all data in Data Recording Sheet.

Fig. 1 - Measuring channel shape

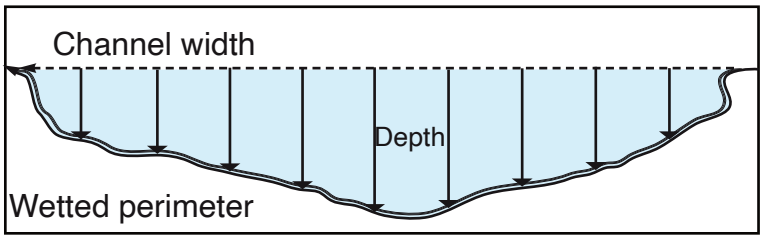


Fig. 2 - Measuring pebble size and roundness

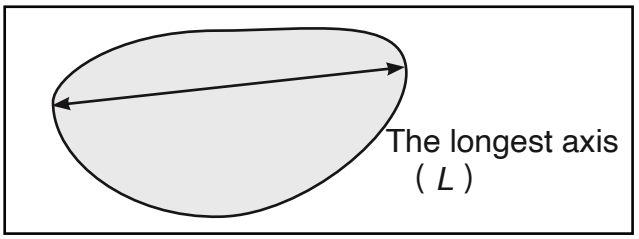
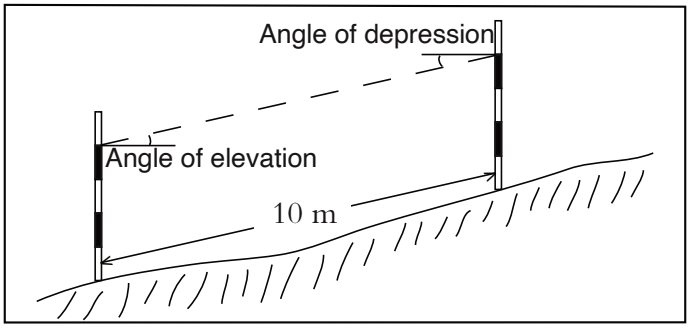


Fig. 3 - Measuring channel gradient



B. Data Collection

Complete the following table.

Primary Data Items	To Examine Hypothesis			Data Collection Method		Equipment Required (Number on the Equipment Checklist)
	1	2	3	Observation	Measuring	
1. Channel width						
2. Channel depth						
3. Wetted perimeter						
4. Roundness of pebbles						
5. Channel gradient						
6. River velocity						

Equipment Checklist

Items	Quantity	Checked	Returned
1. Base map (Individual)	x 1	❑	❑
2. Clipboard (Individual)	x 1	❑	❑
3. Compass (Individual)	x 1	❑	❑
4. Cotton gloves	x 2	❑	❑
5. Measuring tape - 3.5m	x 1	❑	❑
6. Measuring tape - 30m	x 2	❑	❑
7. Abney level	x 2	❑	❑
8. Ranging pole	x 2	❑	❑
9. Level meter	x 2	❑	❑
10. Stream flow meter	x 1	❑	❑
11. Caliper	x 1	❑	❑
12. Cailleux Roundness Index	x 1	❑	❑
13. Timer	x 1	❑	❑
14. Bubble ball	x 1	❑	❑

Think About

List the merits and demerits of measuring river velocity with a stream flow meter.

Data Recording Sheet

		Site A	Site B
1.	Channel width	m	m
2.	Channel average depth	m	m
3.	Cross-sectional area (Channel width x average depth)	m^2	m^2
4.	Wetted perimeter	m	m
5.	Hydraulic radius (Cross-sectional area / Wetted perimeter)	m	m
6.	Average roundness index		
7.	Channel gradient	Average channel gradient angle(θ):_____° tanθ=_____ 1 : _____	Average channel gradient angle(θ):_____° tanθ=_____ 1 : _____
8.	Average river velocity	m/s	m/s
9.	Discharge (River velocity x Cross-sectional area)	m^3/s	m^3/s

Think About

List the advantages of the sampling methods adopted in the fieldwork.

Think About

List the possible errors when collecting data.

C. Data Processing, Presentation and Analysis

1. Complete the data recording sheet, with reference to the data from all the other groups, summarize and compare the following items and circle the correct ansewr.
2. Draw the most appropriate diagrams with graph papers, to show the data.
3. Diagrams appropriate for showing the data include:

Hypothesis 1 : _____ Hypothesis 2 : _____ Hypothesis 3 : _____

	Site A	**Site B**
a. Channel width	Wider / Narrower	Wider / Narrower
b. Channel average depth	Deeper / Shallower	Deeper / Shallower
c. Cross-sectional area	Bigger / Smaller	Bigger / Smaller
d. Wetted perimeter	Longer / Shorter	Longer / Shorter
e. Hydraulic radius	Higher / Lower	Higher / Lower
f. Roundness of Pebbles	Steeper / Gentler	Steeper / Gentler
g. Channel gradient	More rounded/ More angular	More rounded/ More angular
h. Average river velocity	Faster/ Slower	Faster/ Slower
i. Discharge	More/ Less	More/ Less

Think About

List the merits and demerits of the chosen diagrams.

D. Interpretation and Conclusion

1. Does the fieldwork result support the Hypothesis 1: ***The lower the river course, the larger the stream discharge***? Support your conclusion with the collected data and graph. (Extended question: How does the stream discharge shape the land?)

2. Does the fieldwork result support the Hypothesis 2: ***The lower the river course, the smaller the channel friction***? Support your conclusion with the collected data and graph. (Extended question: What factors affect the channel friction?)

3. Does the fieldwork result support the Hypothesis 3: ***The lower the river course, the smaller the channel gradient***? Support your conclusion with the collected data and graph. (Extended question: What is the relationship between channel gradient and river velocity?)

E. Evaluation

1. Base on this fieldwork, suggest how to increase the reliability and validity of the data collection.

E. Evaluation

1. Suggest a fieldwork in Hong Kong with a theme of stream channel study, state clearly the hypothesis and data collection arrangement of the fieldwork.

Further Reading for National Geography

Water resources in the Greater Bay Area

Rivers of our country

Overall national strength - Natural resources and sustainable development (Chinese version only)