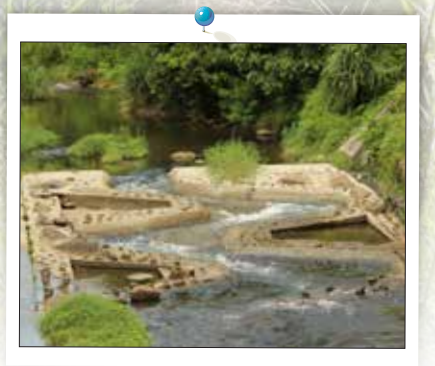
JC-WISE
Water Initiative on Sustainability and Engagement
賽馬會惜水・識河計劃

My River, My Community 河處是吾家

Guided Field Trip to
Lam Tsuen River (林村河) Catchment


Students' Workbook
(Second Edition)

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Lam Tsuen River Field Study: Students' Workbook

Contents

1 About Lam Tsuen River

Lam Tsuen River is located in the central New Territories, west of Tai Po New Town. The river originates from the northern slopes of Tai Mo Shan (大帽山) at a height of 740m above sea level. Its main stream flows north through the famous Ng Tung Chai waterfalls (梧桐寨瀑布群), and Chai Kek (寨虱), and turns northeast after passing Lam Kam Road (林錦公路). The river meanders past Ma Po Mei (麻布尾), San Tong (新塘), Fong Ma Po (放馬莆), and Chuen Pei Lung (川背龍), turning 90 degrees to head southeast when it reaches Wai Tau Tsuen (圍頭村). It continues flowing to Shui Wai (水圍) via Mui Shue Hang (梅樹坑), converges with Tai Po River at Tai Po New Town, and finally enters Tolo Harbour (吐露港) by Kwong Fuk Estate (廣福邨). Lam Tsuen River is about 10.8km long, with a catchment area of approximately 21km^2.

"Rivers@HK Database"
[Lam Tsuen River > Lam Tsuen River Location and Catchment > About Lam Tsuen River]
http://www.jcwise.hk/gis/lam_tsuen_river_map_series.php?lang=en

🕮 Students' Workbook - Exercise

Answer the following questions:

(1) Refer to Map 1.0, describe the different directions that Lam Tsuen River flows.

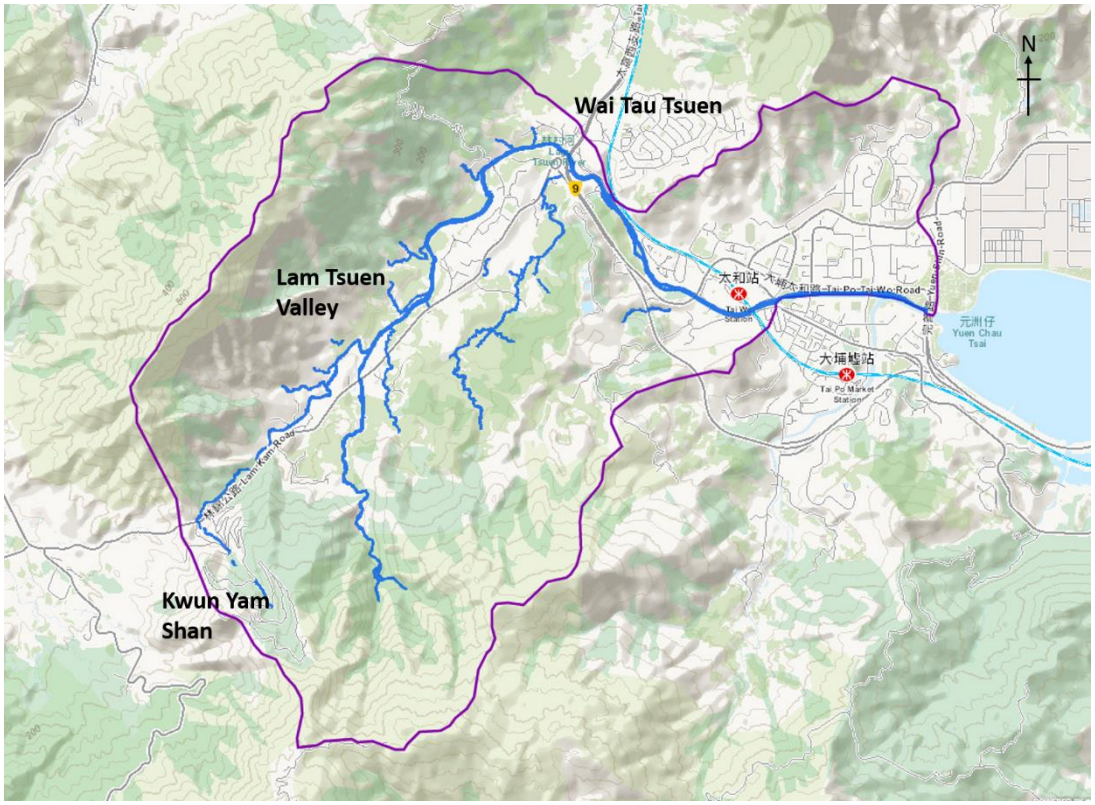
_____

_____

_____

_____

Map 1.0: Lam Tsuen River



(2) What is the height of Kwun Yam Shan? _____

(3) Name the Lam Tsuen River's drainage pattern.

_____

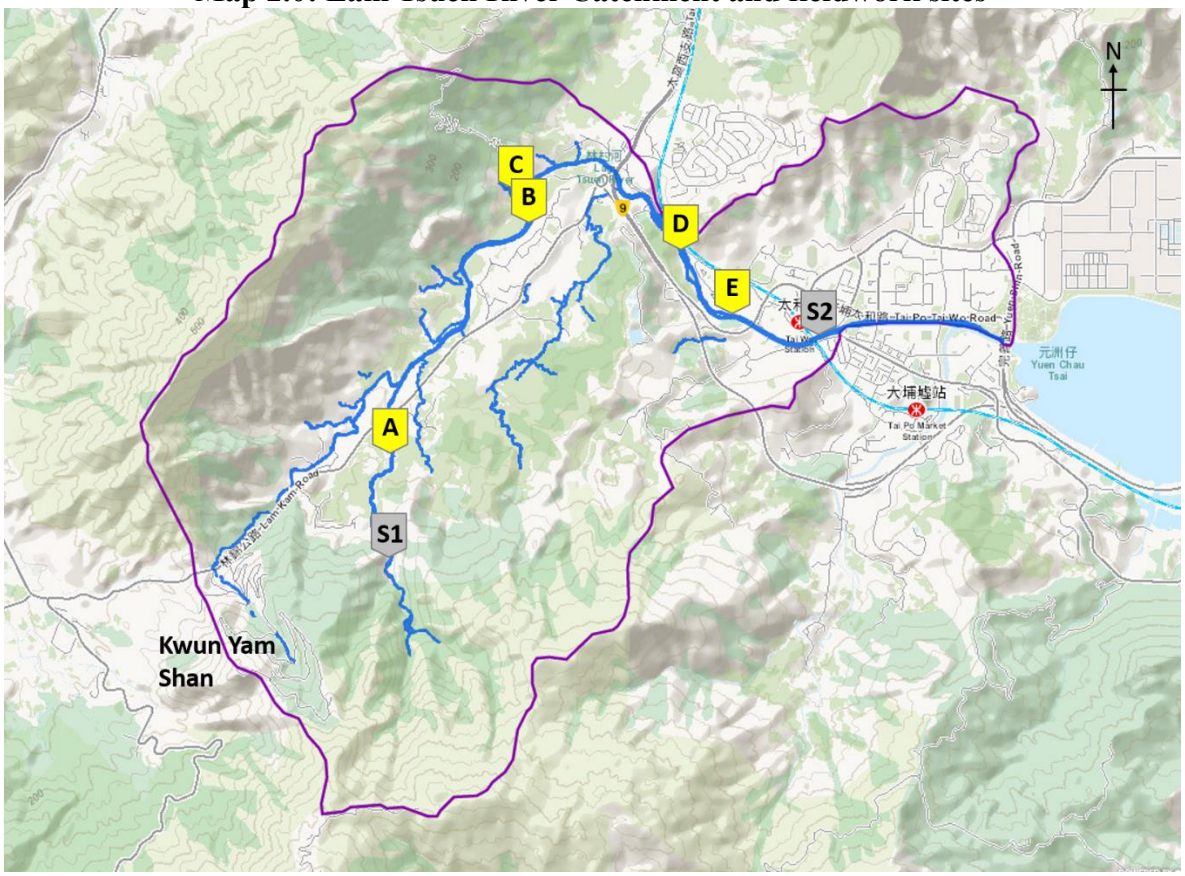
(4) Refer to Map 1.1, identify the type of river mouth.

A. Estuary B. Delta

Map 1.1: Mouth of Lam Tsuen River

2 Lam Tsuen River and Fieldwork Sites

Map 2.0: Lam Tsuen River Catchment and fieldwork sites



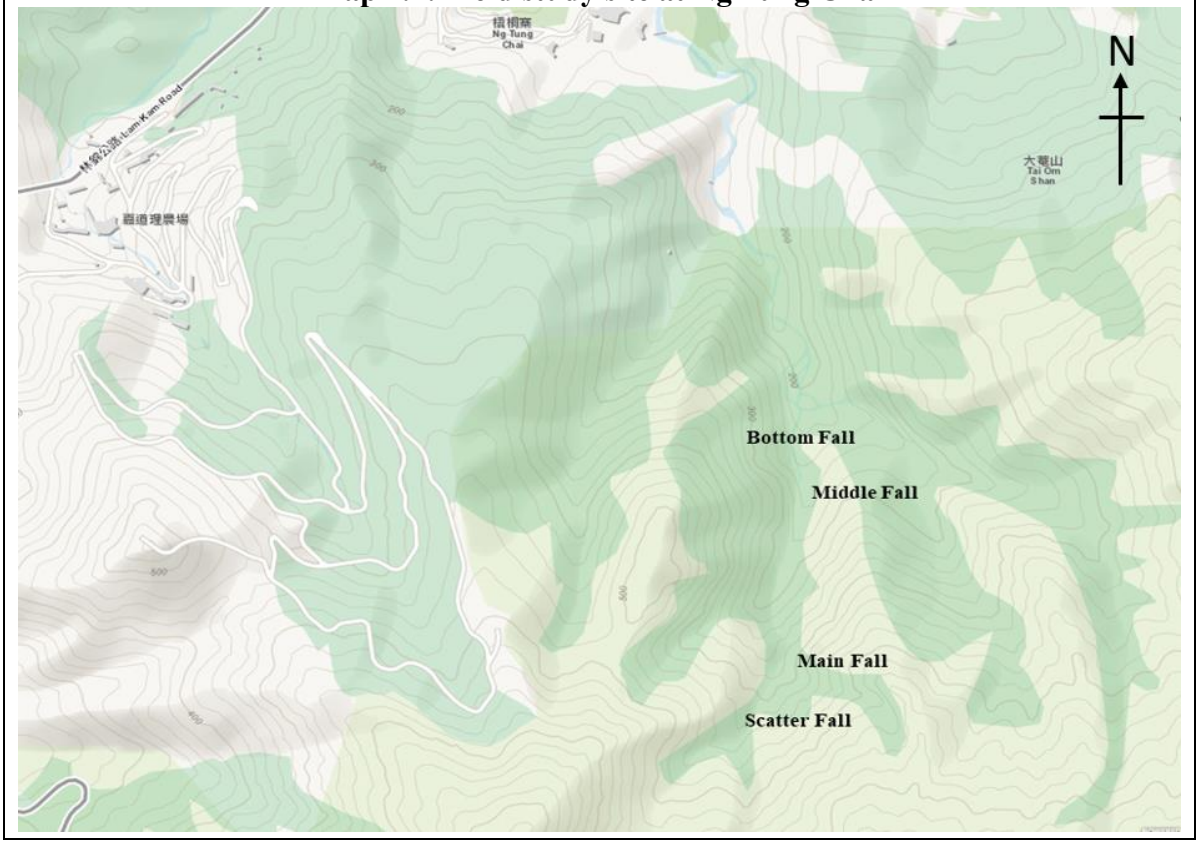
- **S1** • **Ng Tung Chai**（梧桐寨）- Waterfall
- **A** • **Chai Kek**（寨虺）- Natural stream
- **B** • **Fong Ma Po**（放馬莆） - Eco-friendly river channel
- **C** • **Chuen Pei Lung**（川背龍）- Fish ladder
- **D** • **Tai Po Tau Pumping Station**（大埔頭抽水站）- Waterworks
- **E** • **Tai Po Tau Shui Wai**（大埔頭水圍）- Ecological restoration site
- **S2** • **Tai Wo Bridge**（太和橋）- Lower course channel (near river mouth)

2.1 Fieldwork Site S1: Ng Tung Chai

Ng Tung Chai, located on the upper reaches of Lam Tsuen River, has been designated a Site of Special Scientific Interest (SSSI). The majority of the valley area is within Tai Mo Shan Country Park, where the natural beauty of the upper course is preserved. Most animals and plants found in the area are small or well adapted to living within fast-flowing rapids, while comparatively larger plants can be found downstream. The Ng Tung Chai River Valley is also an important habitat for dragonflies.

'My River, My Community' – Eco Tour
[Site A: Ng Tung Chai]
http://www.jcwise.hk/mrmc/lt_e/index.php?lang=en

Map 2.1: Field study site at Ng Tung Chai



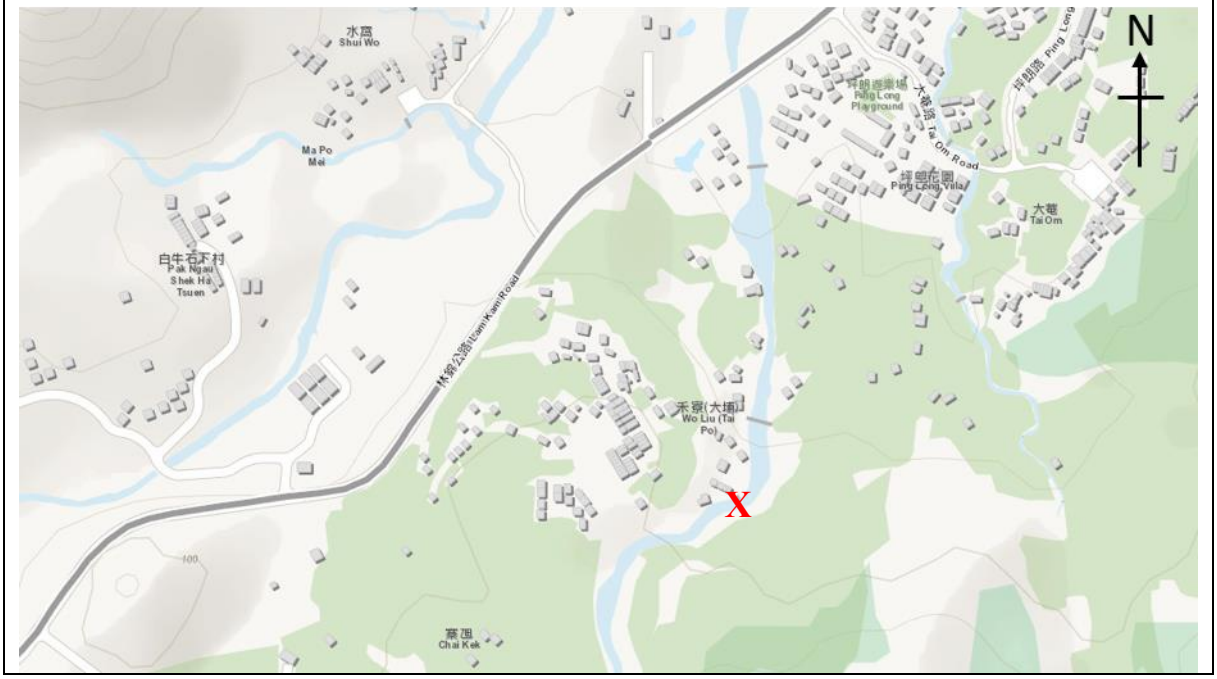
2.2 Fieldwork Site A: Chai Kek

The Chinese character "Chai" 「寨」 means temporary housing, referring to Hakka settlement in this context. The character "Kek" ("洫") comprises "乙", referring to the winding river, and "田", meaning farmland. "洫" can thus be interpreted as an area where farmland is surrounded by a winding river.

Near Chai Kek, scattered boulders can be seen in the river channel, a typical feature of the upper course of a river. The steep channel gradient also creates rapids.

'My River, My Community' – WISE Choice
[Site A: Chai Kek]
http://www.jcwise.hk/mrmc/lt_w/index.php?lang=en

Map 2.2: Field study site at Chai Kek



2.3 Fieldwork Site B: Fong Ma Po

The village of Fong Ma Po is located along the upper course of Lam Tsuen River, together with numerous other rural settlements. Ornamental plants, such as peach blossom and tangerines, are widely cultivated on adjoining farmland.

The Hong Kong government's Agriculture, Fisheries and Conservation Department has designated the river's upper course as one of its "Ecologically Important Streams".

However, some sections had to undergo drainage improvement works from 2007-12 to prevent flooding.

To mitigate impact on the environment, the Drainage Services Department undertook a series of environmental measures, for example, placing gabions and pebbles on river banks and the riverbed respectively, to provide habitats for riverine flora and fauna.

'My River, My Community' – WISE Choice
[Site B: Fong Ma Po]
http://www.jcwise.hk/mrmc/lt_w/index.php?lang=en

Map 2.3: Field study site at Fong Ma Po

Stream channel at Fong Ma Po

2.4 Fieldwork Site C: Chuen Pei Lung

The relatively good water quality of Lam Tsuen River's middle course supports common fish species such as Freshwater Minnow (*Zacco platypus*) and Chinese Barb (*Puntius semifasciolatus*). The unpolluted riverine environment also provides a suitable habitat for Hong Kong Newts (*Paramesotriton hongkongensis*), a protected species under the Wild Animals Protection Ordinance Cap 170.

In addition to drainage improvement along the river's upper course, the Drainage Services Department carried out works along its middle course between 2007-12 to reduce the risk of flooding in Lam Tsuen Valley. Multiple eco-designs were adopted to take conservation into account. These included building gabion walls on river banks to provide suitable growing environments for different species and constructing a fish ladder to maintain flow continuity and allow river organisms to swim upstream.

The improvement works have since helped to enhance the river's biodiversity, with its population of Hong Kong Newts increasing.

'My River, My Community' – WISE Choice
[Site C: Chuen Pei Lung]
http://www.jcwise.hk/mrmc/lt_w/index.php?lang=en

Map 2.4: Field study site at Chuen Pei Lung

Fish ladder at Chuen Pei Lung

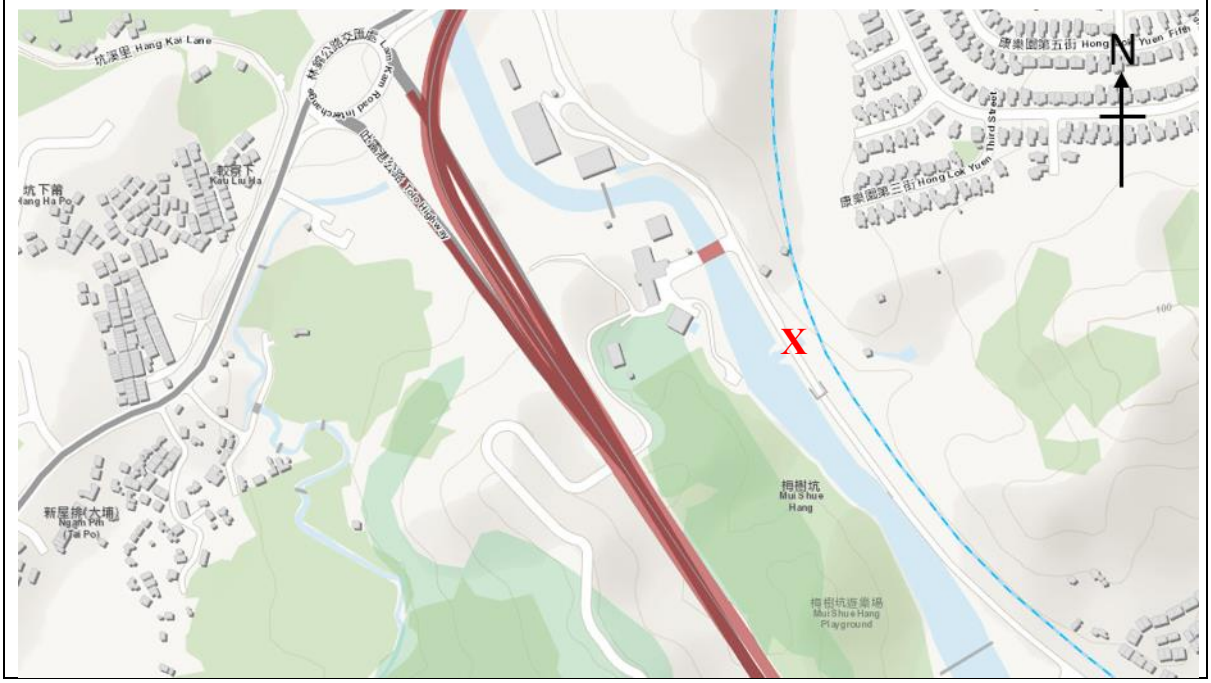
2.5 Fieldwork Site D: Tai Po Tau Pumping Station

The Hong Kong government constructed Plover Cove Reservoir – Hong Kong's largest reservoir in area – in the 1960s to address the city's acute water supply problem, as well as associated waterworks, including Tai Po Tau Pumping Station at Mui Shue Hang village. At the same time, the upper and middle courses of Lam Tsuen River were designated water catchment areas.

Since installation of an inflatable nylon dam (fabridam), Tai Po Tau Pumping Station has pumped stored river water from the upper and middle sections of Lam Tsuen River to Plover Cove Reservoir, which in turn has led to a considerable decrease in the river's discharge in its lower course.

'My River, My Community' – WISE Choice
[Site D: Tai Po Tau Pumping Station]
http://www.jcwise.hk/mrmc/lt_w/index.php?lang=en

Map 2.5: Field study site at Tai Po Tau Pumping Station



Channelisation

To reduce the threat of flooding in Tai Po, sections of Lam Tsuen River downstream from Tai Po Tau Pumping Station underwent channelisation as early as 1984. The river channel was straightened, deepened, and widened, while river banks and riverbed were paved with bricks and concrete respectively. Such river training transformed the natural river into a man-made nullah. Recent years have seen vegetation cultivated on the riverbed between the villages of Mui Shue Hang and Tai Po Tau Shui Wai, enhancing the aesthetic value of the riverine environment.

Inflatable fabridam at Mui Shue Hang

2.6 Fieldwork Site E: Tai Po Tau Shui Wai

The channelisation of the downstream section of Lam Tsuen River as a flood prevention measure led to the loss of riverine habitats and disturbance of the river's ecosystem.

In 2016, the Drainage Services Department launched an ecological restoration pilot study employing eco-friendly river channel designs in a section of Lam Tsuen River near the village of Tai Po Tau Shui Wai. The study showed that the fauna population in the pilot study area outnumbered those in other areas of the channel, indicating the impact of ecological enhancement.

'My River, My Community' – WISE Choice
[Site E: Tai Po Tau Shui Wai]
http://www.jcwise.hk/mrmc/lt_w/index.php?lang=en

Map 2.6: Field study site at Tai Po Tau Shui Wai

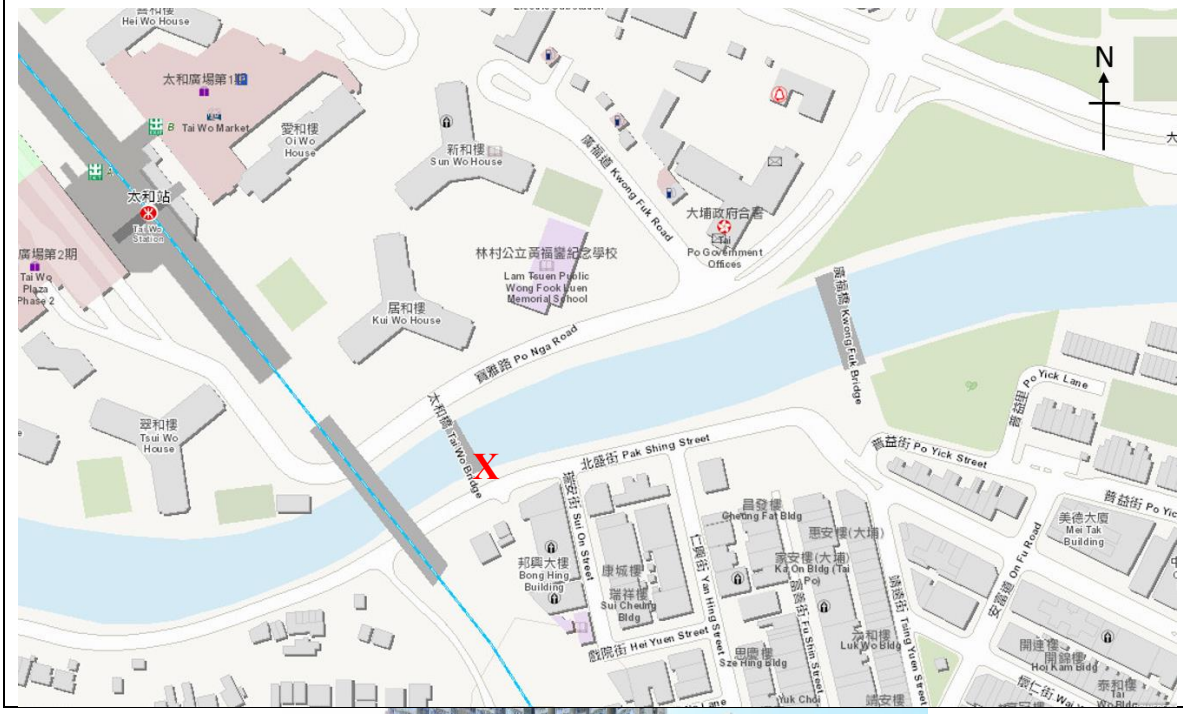
Eco-friendly river channel design at Tai Po Tau Shui Wai

2.7 Fieldwork Site S2: Tai Wo Bridge

Kwong Fuk Bridge was converted to a road bridge in 1948. As a result, Tai Wo Bridge was built nearby Kwong Fuk Bridge to provide a footbridge for people to cross Lam Tsuen River in the early 1990s.

'My River, My Community' – Cultural Tour
[Site B: Tai Wo Bridge]
http://www.jcwise.hk/mrmc/lt_c/index.php?lang=en

Map 2.7: Field study site at Tai Wo Bridge



Tai Wo Bridge

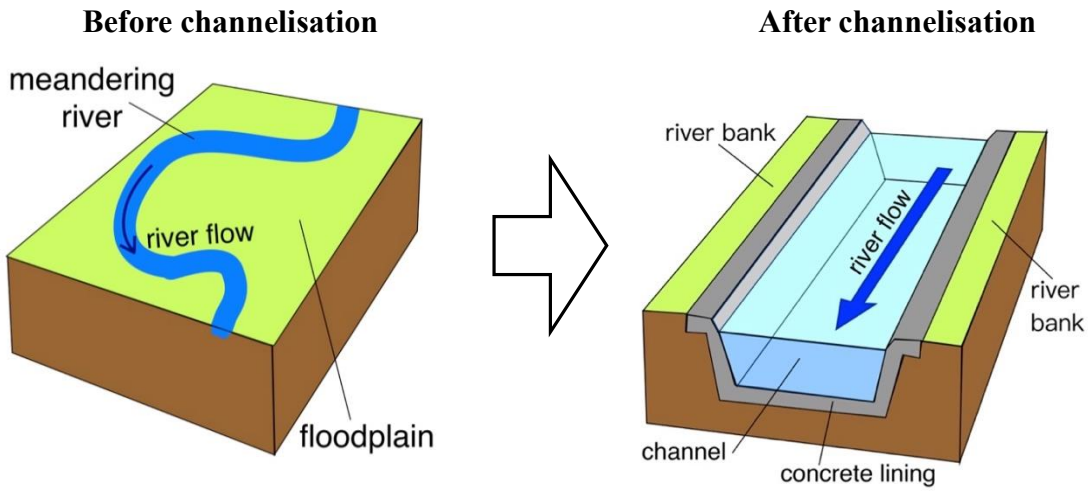
3 Recap on Channel Management for Students

Recap (1)

Channelisation

Channelisation is a deliberate attempt to alter the natural geometry of the river. Based on the following figure showing the river course and channel before and after channelisation, indicate the effects of channelisation on the river channel and hydraulic efficiency in the table below.

Figure 3.1: River channel before and after channelisation



The effects of channelisation on:		
● River channel	● Riverbed	● River's capacity, hydraulic efficiency, and discharge

Reminder: When conducting river channelisation studies, DO consider the cost, ecological impacts, and effectiveness in coping with low-frequency but high-magnitude flood events.

Recap (2)

Hard engineering strategies on channel management

To revisit the different types of channel and river bank management with students, teachers can make use of the following table, showing the common hard engineering strategies employed in channelisation and river bank protection in Hong Kong.

Complete the table below:

	Hard strategies	Cost	Advantage(s)	Disadvantage(s)
1	Block revetment（舖磚塊） 			
2	Gabion wall（石籠牆） 			
3	Concrete cover（舖混凝土） 			
4	Stone pitching retaining wall （石砌護土牆） 	Very high		

Recap (3)

Ecological enhancements in channelisation

The Drainage Services Department has incorporated the following environmentally friendly designs into channelisation:

	Type		Description
1	**Grasscreting** along channel embankments		• Enhances aesthetic value • Diversifies micro-habitats
2	Reinforcing **grass linings** in **gabions**		• Stabilises channel side slopes
3	**Unlined channel bed** and embankment		• Enables colonisation of flora and fauna, facilitating vegetation growth
4	Creating **shallow ponds**		• Used as aquatic planting bays to allow freshwater fish, amphibians, and water birds to thrive
5	Creating **wetland** habitats		• Diversifies wildlife species
6	Building **fish ladders**		• Overcomes the steep gradient of a stream

For details of DSD ecological enhancement works, visit:

	Flood Prevention: Environmentally Friendly Designs **http://www.dsd.gov.hk/EN/Flood_Prevention/Ecological_Enhancement/Environmentally_Friendly_Designs/**

Recap (4)

Ecosystem services

Ecosystem services are the benefits that people can obtain from ecosystems. According to The Economics of Ecosystem and Biodiversity (TEEB) initiative, launched in Germany in 2007, ecosystem services can be categorised into four main types, as shown in the table below:

	Ecosystem services	Explanation	Examples from the river ecosystem
1	Provisioning services	Products obtained from ecosystems	• food • •
2	Regulating services	Benefits obtained from regulation processes of ecosystems	• water purification •
3	Supporting services	Habitats provided by ecosystems	• nutrient cycling •
4	Cultural services	Non-material benefits that people obtain from ecosystems	• aesthetic value • •

Further reading on ecosystem services

Gopal, B. (eds.) (2013). Environmental Services of Rivers and Their Relations to Flows. In *Environmental Flows: An Introduction for Water Resources Managers* (pp. 67-79). New Delhi, India: National Institute of Ecology.

Millennium Ecosystem Assessment (2005). *Ecosystems and Human Well-being: Synthesis*. Washington, DC: Island Press.

4 Survey and Appraisal for Channel Management Works

The Record Form on page 22 is used in surveying and appraising the environmental impacts of different hard engineering strategies employed in channelisation and river protection works. It is recommended that the survey and appraisal are carried out by senior secondary students at the following fieldwork sites:

(a) Site B: Fong Ma Po

(b) Site C: Chuen Pei Lung

(c) Site D: Tai Po Tau Pumping Station

(d) Site E: Tai Po Tau Shui Wai

(e) Site S2: Tai Wo Bridge.

Channel Management Works Record

Locality:	Date:	Weather:
Section of the river: ☐ Upper course ☐ Middle course ☐ Lower course		
Land use along the river:		
About the channel management works		
Type: ☐ Blocks revetment ☐ Gabion wall ☐ Concrete cover ☐ Stone pitching retaining wall Description:		
Ecological enhancement: ☐ Grasscrete ☐ Grass linings in gabions ☐ Unlined channel bed ☐ Shallow pond ☐ Wetland ☐ Fish ladder Description:		
Intended effects (major purposes):		
Aesthetic value:	Cost:	
Effects on the river's hydraulic efficiency		
Channel width: (find the width by using a large-scale map or direct measurement)		
Channel characteristics (e.g. roughness):		
River discharge:	Velocity of water flow:	
Ecosystem services created by management works		
Provisioning services:		
Regulating services:		
Supporting services:		
Cultural services:		
Remarks:		

5 Enquiry-based Field Study for Junior Secondary Students (📖 Students' Worksheet)

Introduction

A number of ecological enhancement works can be observed along Lam Tsuen River, for example, fish ladders, habitat designs for the aquatic ecosystems, etc. The installation of such works helps balance the needs of river management and the ecosystem.

Enquiry question

How do ecological channel management works vary along the course of the river?

What data to collect?

- Major land use along the channel
- Major function(s) of the section of the river being studied
- Major ecological enhancement work(s)

Where to collect data?

- Fieldwork sites C (Chuen Pei Lung) to E (Tai Po Tau Shui Wai)
- Additional fieldwork sites may be added

How to collect data?

- Refer to the common types of ecological enhancement in channelisation works in Hong Kong on page 19.

• Grasscreting	• Grass linings in gabions	• Unlined channel bed
• Shallow pond	• Wetland	• Flow deflector

- Identify the type of ecological enhancement at the field sites visited.
- Take photos of the ecological enhancement work.
- Carry out observations on land uses.
- Estimate the channel width, proportion, and degree of ecological enhancement works.

Data presentation

- With reference to your observations during fieldwork, complete the table on page 24.

Fieldwork site	(C) Chuen Pei Lung	(D) Tai Po Tau Pumping Station	(E) Tai Po Tau Shui Wai	*(Additional fieldwork site)*
Observations				
Major land use along the channel	☐ agricultural ☐ residential ☐ industrial ☐ abandoned land ☐ construction in progress ☐ others:	☐ agricultural ☐ residential ☐ industrial ☐ abandoned land ☐ construction in progress ☐ others:	☐ agricultural ☐ residential ☐ industrial ☐ abandoned land ☐ construction in progress ☐ others:	☐ agricultural ☐ residential ☐ industrial ☐ abandoned land ☐ construction in progress ☐ others:
Major function(s) of the river section	☐ erosion ☐ transportation ☐ deposition ☐ remarks:	☐ erosion ☐ transportation ☐ deposition ☐ remarks:	☐ erosion ☐ transportation ☐ deposition ☐ remarks:	☐ erosion ☐ transportation ☐ deposition ☐ remarks:
Major ecological enhancement work(s)				
Evidence				
Sketch/ photographic evidence of ecological enhancement work(s)				
Measurement				
Estimated/ measured channel width (metres)				
Proportion of ecological enhancement works (as a percentage of the channel width)				

Level of ecological enhancement works	☐ High ☐ Medium ☐ Low	☐ High ☐ Medium ☐ Low	☐ High ☐ Medium ☐ Low	☐ High ☐ Medium ☐ Low

Discussion and findings

- With reference to the table on page 24:

  (i) Describe the changes of ecological enhancement works in a downstream direction.

  (ii) Explain such changes with reference to the major land use along the channel and the major function(s) of the section of the river being studied.

- Discuss the roles of humans in modifying the river channel environment, incorporating ecological enhancement works along Lam Tsuen River as examples.

6 Enquiry-based Field Study for Senior Secondary Students (📖 Students' Worksheet)

Enquiry Question

Is there any difference in river discharge between the upper, middle, and lower courses of Lam Tsuen River?

What data to collect?

- Velocity of water flow (time taken for a float to travel over a chosen distance in a channel)
- Width of the river surface across the channel
- Depth of river water in the channel

Where to collect data?

- Fieldwork site A: Chai Kek (selected site, upper course)
- Fieldwork site B: Fong Ma Po (selected site, middle course)
- Fieldwork site S2: Tai Wo Bridge (selected site, lower course)

When to collect data?

- In the wet season, but should avoid collecting data on rainy days, and three to four days after heavy rain
- Collect data during ebb tides
- Avoid days when the river mouth is exposed to direct strong winds from the east

How to collect data?

Preparation

- Work in a group of four or more at one site.
- Work with other groups, taking data at the same time at each site.
- Each group should bring the following tools: measuring tape, measuring rod, laser distance meter, float (with string), lead weight, rope with metre marking, and timer (optional).

- Each group is responsible for collecting data on flow velocity and a cross-sectional area (width X mean depth) of channel water at the site. Multiplying these two variables will give river discharge.

Measuring procedures

- Measuring the flow velocity of Lam Tsuen River
  - ✓ Select two points at the channel near the study site, preferably more than five metres apart at the upper course, 20 metres at the middle course, and 40 metres at the lower course.
  - ✓ Drop a float at the upstream point.
  - ✓ At the same time, start the timer.
  - ✓ Stop the timer when the float passes the downstream point.
  - ✓ Collect the float.
  - ✓ Record the timer reading.
  - ✓ Repeat the whole procedure five times, with intervals of 10 minutes between measurements.
  - ✓ Record the five sets of data on the form below:

Data Record Form 1

Time of record	Float travelling time	*Velocity of water flow (m/sec)	Result adjusted for "correction factor"
			Mean velocity = Average velocity of surface water flow X 0.8 =_____ m/sec *(rounded to two decimal places)*
	Average:	m/sec	

*Velocity of water flow (m/sec) = Distance travelled (m)/ Time travelled (sec)

- Measuring the width of water surface in Lam Tsuen River
  - ✓ Choose a transect across the channel between two selected points near the study site.
  - ✓ At the upper course site, use a measuring tape to measure the shortest distance between the two points where the water surface is in contact with each side of the channel.

- ✓ At the middle or lower course sites, measure the shortest distance between the two points with a laser distance meter. Alternatively, measure the length of the Tai Wo Bridge across the river with a measuring tape.
- ✓ Record the reading on Data Record Form 2.

- Measuring the depth of water in Lam Tsuen River
  - ✓ Along the transect chosen for the study site, use a measuring tape to mark sampling points at regular intervals: 1m at the upper course, 2m at the middle course, and 3m at the lower course (systematic sampling).
  - ✓ At each sampling point for the upper course, place a measuring rod vertically on the river bed.
  - ✓ Take the reading from the rod and enter the data on Data Record Form 2. Repeat these procedures for other sampling points at the site.
  - ✓ At each sampling point for the middle or lower course, drop a rope with a lead weight into the water from the bridge until it reaches the river bed. Mark on the rope where it touches the top of the bridge sidewall.
  - ✓ Pull the lead weight up until its tip is in contact with the channel water. Mark on the rope again where it touches the top of the bridge sidewall.
  - ✓ Measure the distance between the two marks on the rope to find the river depth, and enter the data on Data Record Form 2. Repeat these procedures for other sampling points at the sites.
  - ✓ Add up all the readings from each site, divide the sum by the number of measurements, and enter the result into the box for "(D)" on Data Record Form 2.

Data Record Form 2

Distance from river bank (m)	Depth of water (m)

Mean depth of channel water (D):	
Width of water surface in the channel (W):	
Cross-sectional area of channel water (A) = D x W:	
Flow velocity of channel water (V):	
River discharge (Q) = A x V:	

Data processing and presentation

1. Complete the remaining boxes on Data Record Form 2, and find the river discharge at each site.
2. Draw a bar graph to show the river discharge at the three study sites.

Data analysis and findings

1 Based on your bar graph, is there any difference in river discharge between upper, middle, and lower courses of Lam Tsuen River?

2. Does the bar graph suggest any pattern of change in river discharge? If yes, describe the pattern shown. Quote evidence from the graph to support your answer.

Field study evaluation and discussion

1. Why does river discharge vary among the different courses of Lam Tsuen River? Use field and map evidence to support your answer.
2. Were the date and time of the field study well chosen? Why?
3. Why were two different methods adopted in measuring the width and depth of the river channel at different sites? What are the relative advantages and disadvantages of these two methods?
4. Describe and explain how the data collection method could be redesigned to raise the validity and reliability of the field study.
5. In addition to the data collected in the above field study, suggest other primary and secondary data you might collect to further investigate the river. Explain how the data could be collected.