SG. KINTA RIVER OPEN CLASSROOM:

RIVERWALK

GUIDEBOOK

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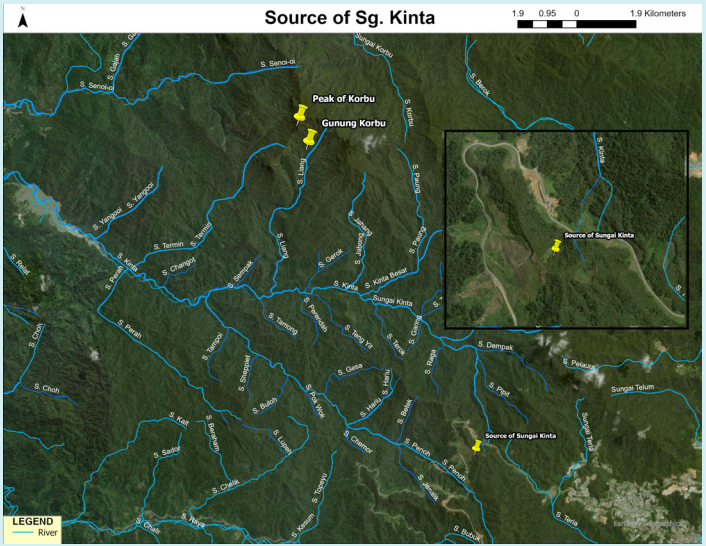
SG. KINTA



The Sungai Kinta, which forms the Kinta Valley is bounded by the main range to the east the Keledang Range to the west.

Sg. Kinta which originates from Gunung Pass and the downstream of Sg. Kinta adjoins into Sg. Perak at Kampung Gajah. Sg. Kinta provides a significant benefit from the provision of water supply, besides being used for recreational purposes.

The Sungai Kinta which flows from Gunung Pass in Ulu Kinta at an altitude of around 2000 m above the sea level is 110 km long with the catchment area of 2,540 km².

The Sg. Kinta have main 7 tributaries; Sg. Pari, Sg. Buntong, Sg. Kledang, Sg. Raya, Sg. Pinji, Sg. Johan, Sg. Kampar and Sg. Chenderiang.

Sg Kinta reported WQI of 76 (Class III, slightly polluted) as of 2019. (DOE, 2019).

MAINSTREAMING OF BIODIVERSITY CONSERVATION INTO RIVER MANAGEMENT: UPPER KINTA BASIN, PERAK

Mainstreaming Biodiversity in River Management is a project by United Nations Development Programme, Global Environment Facility (UNDP-GEF) and Department of Irrigation and Drainage, Malaysia. The project is focused on addressing the root causes and barriers to the conservation of riverine biodiversity through the development of strategies and promotion of best management practices and capacity building for key stakeholders. Upper Kinta Basin, Perak is one among three pilot demonstration sites for Component 2 that shows best management practices.

The focus of the project in Upper Kinta Basin is on the management of the upper catchment of Sg Kinta that is important for biodiversity conservation and water supply purposes. The project aims to improve understanding and the status of riverine biodiversity and improve the conservation of riverine biodiversity through strengthened watershed management via pilot soil bio-engineering demonstration site, especially through reduction of sediment loading from highway and agro-tourism developments, as well as strengthening communication between the dam operator, government agencies, private players and local communities to ensure sustainable land uses.

Following that, the Sungai Kinta River Open Classroom (SKROC) was established in 2021, where it is located at the source of Sungai Kinta at the coordinate of 4°35'42.37" N101°20'55.94"E. The establishment SKROC involve a range of local stakeholders with emphasis on Orang Asli (OA) communities mainly for its restoration works. Kg Pawong also be engaged and become the custodian for the SKROC.

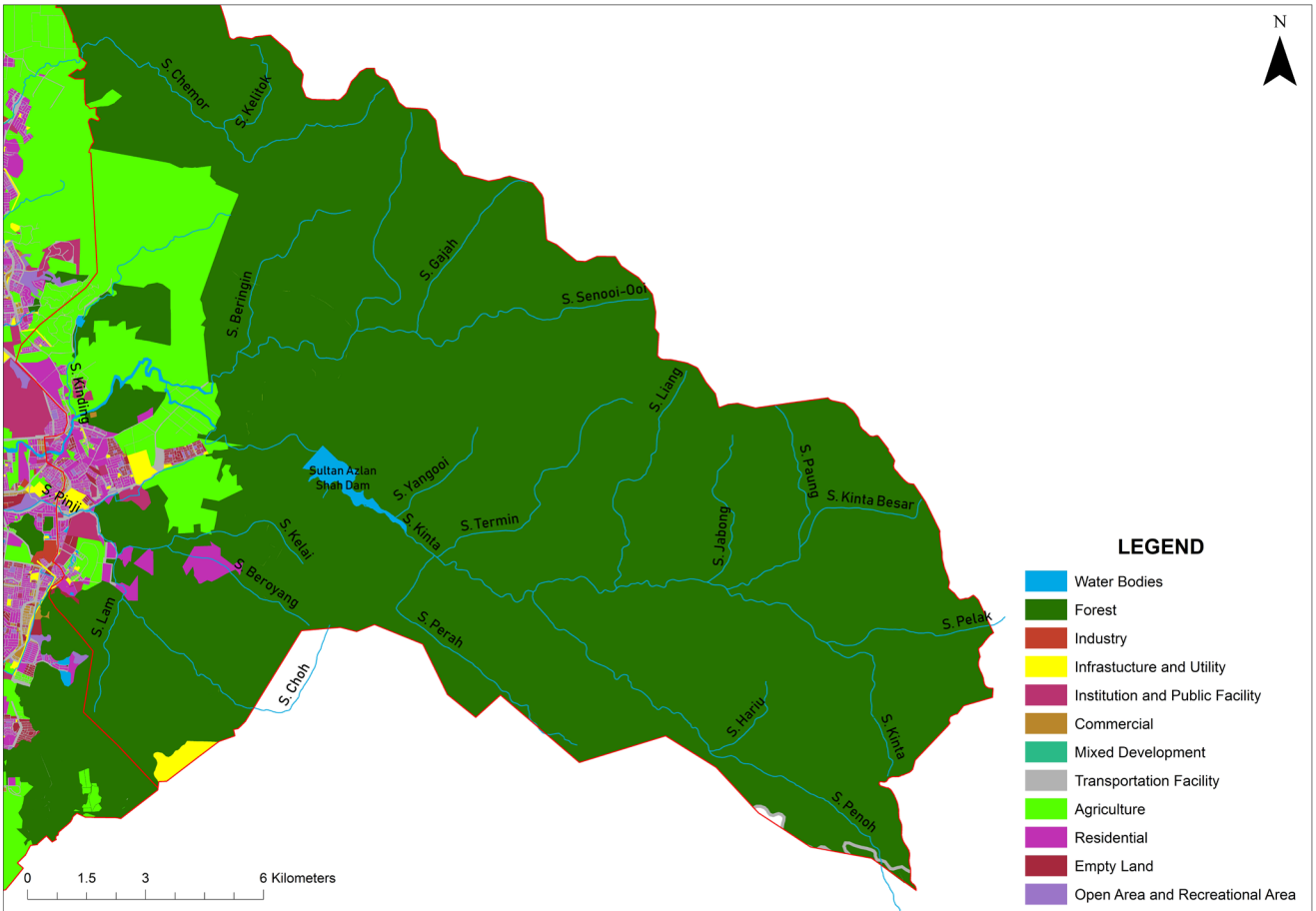
UPPER KINTA BASIN (UKB)

The Upper Kinta Basin in Perak covers area of about 31,470 ha above Ipoh city in Perak. Overall the largest land use type is forest, which covers about 85.3% (26,841 ha). Within the forested area, Bukit Kinta is on the main range known as Environmentally Sensitive Area (ESA) in Perak where Bukit Kinta Permanent Forest Reserve covers most the forest land uses. It provides a critical role in safeguarding the water supply for Ipoh city as well for biodiversity conservation.

Kinta River is the main river flowing in Upper Kinta Basin. The Kinta River is the main water source of the municipal water pipeline to the urban and peri-urban areas. Lembaga Air Perak (LAP) operates the Sultan Azlan Shah dam and the two water treatment facilities; the Sungai Kinta Water Treatment Plant (WTP) and Ulu Kinta WTP.

Total Economic Valuation (TEV) for ecosystem services for 10 years study, reported watershed services contributing the highest (1.65 billion, 71%) contribution compared to other services, indicating UKB catchment as valuable watershed (GEC & Hasanah, 2021)

It is also the home and traditional territory for a range of local stakeholders, especially the Orang Asli (OA) communities, such as Kg Pawong, located above Sultan Azlan Shah dam was engaged and empowered to support slope erosion monitoring and control in the upper catchment using bio engineering concept while Kg Chadak, Kg Tonggang, Kg Suluh, Kg Makmur, Kg Tonggang as well as Kg Choh, located below the dam engaged and empowered on environmental awareness as well as river, forest and pollution monitoring.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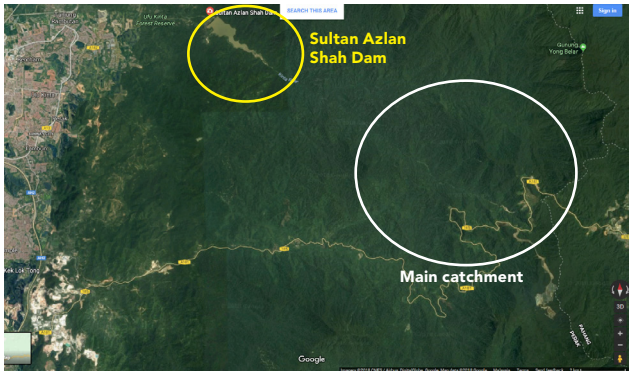
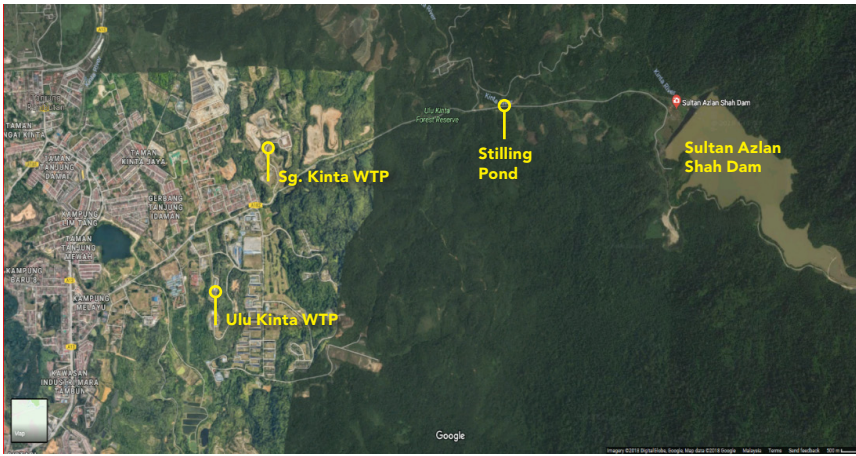
S. Chemor
S. Keliok
S. Beringin
S. Gajah
S. Senooi-Ooi
S. Kandis
S. Liang
S. Pinji
Sultan Azlan Shah Dam
S. Yangooi
S. Kinta
S. Termin
S. Paung
S. Kinta Besar
S. Kelai
S. Jabong
S. Beroyang
S. Lam
S. Perah
S. Pelak
S. Chah
S. Hariu
S. Kinta
S. Penoh
0
1.5
3
6 Kilometers
LEGEND
Water Bodies
Forest
Industry
Infrastucture and Utility
Institution and Public Facility
Commercial
Mixed Development
Transportation Facility
Agriculture
Residential
Empty Land
Open Area and Recreational Area





Ulu Kinta WTP (*Source: SKE Alliance)*

Sg Kinta WTP (*Source: Salcon:Water Engineering And Construction)*

UKB RIVERINE BIODIVERSITY STUDY

UKB Riverine Biodiversity study conducted in July 2020 through GEF5 project reported was good findings for UKB.

A total of 281 fish individuals, comprising 18 species from eight families were identified in all study sites. Cyprinidae was the most dominant family overall with 200 individuals which is 71.3%,

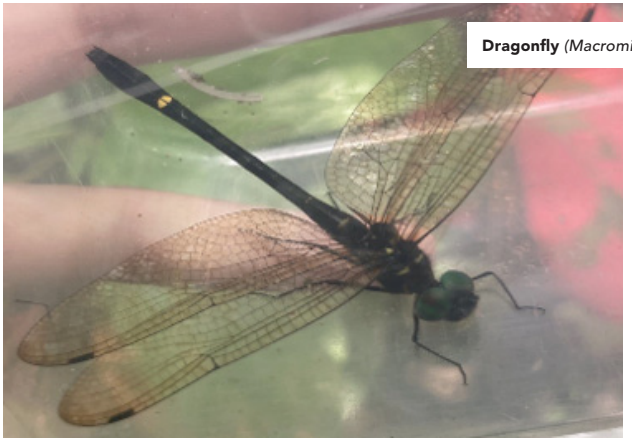
For odonates (dragonflies), a total of 170 individuals, comprised of eight families and 24 species were recorded in the study area.

For avifauna, a total of 132 bird species from 46 families were recorded and identified from the study area at Upper Kinta Basin (UKB). Overall, the distribution of birds in this study are in good state as 16% of the total bird species of Malaysia were present in the study areas. Bulbuls were the most widely recorded group of species with 14 species from this family.

A total of 552 species from 101 plant families were recorded during a rapid terrestrial flora inventory in July 2020.

A total of 269 individuals from 23 families of benthic macroinvertebrates sampled within 8 days of sampling. It was found that Heptageniidae (flattened mayfly) holds the highest distribution with 47 (17.5%) individuals found during sampling period. High abundance of flattened mayfly shows that overall UKB is in very good biological river water quality status.

During the study and extension of camera trapping exercise until March 2021, 12 mammal species found in UKB: Ten terrestrial mammals and two arboreal mammals including critically endangered species such as Malayan Tiger and Black Panther.



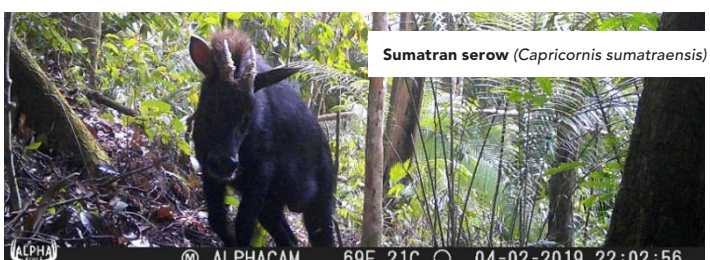
Dragonfly *(Macromia callisto)*

Rafflesia *(Rafflesia cantleyi)*

Tengas *(Neolissochilus soroides)*

Barking Deer *(Muntiacus muntjak)*

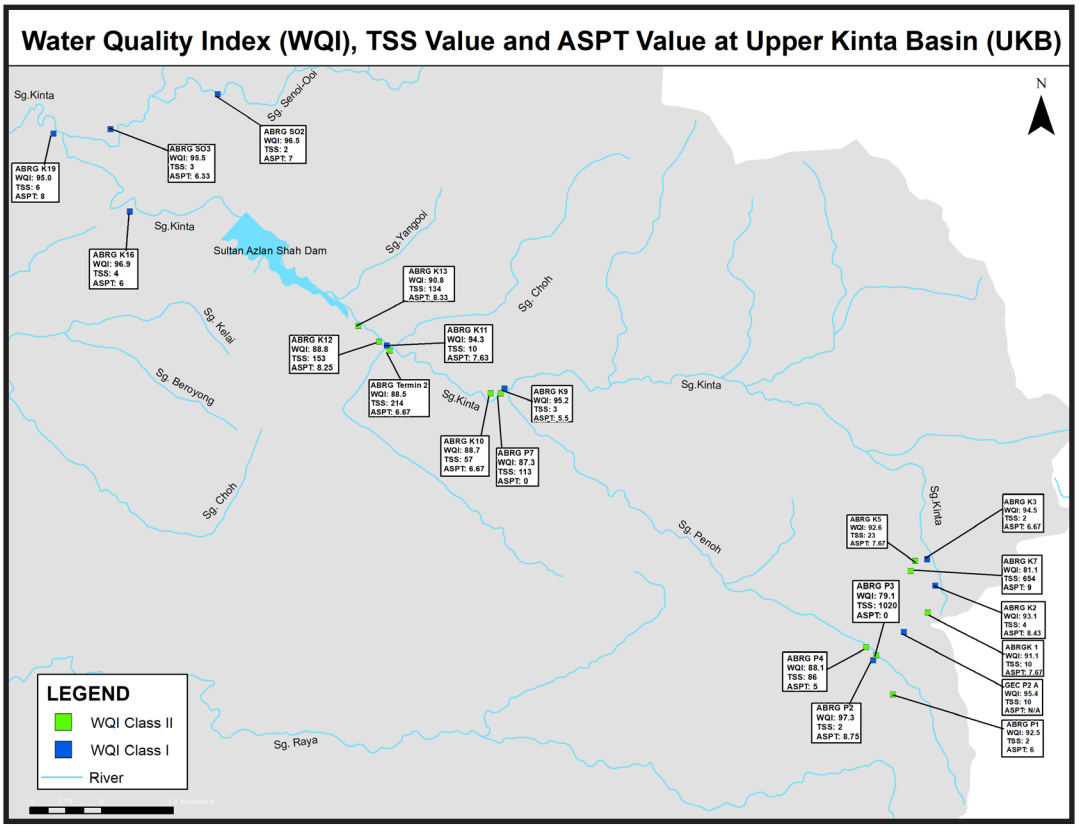
Black Panther *(Panthera pardus)*



Sumatran serow *(Capricornis sumatraensis)*

UKB WATER QUALITY STUDY

Overall average Water Quality Index (WQI) value for all sampling sites at Upper Kinta Basin (UKB) is 91.5 indicates upper limit of class II category. Total suspended solid (TSS) (mg/L) parameter is a parameter greatly varies (2 mg/L (class I) to 1020 mg/L (class V)) between 21 sampling points. This is mainly due to erosion and sedimentation impacts.



SG. KINTA RIVER OPEN CLASSROOM

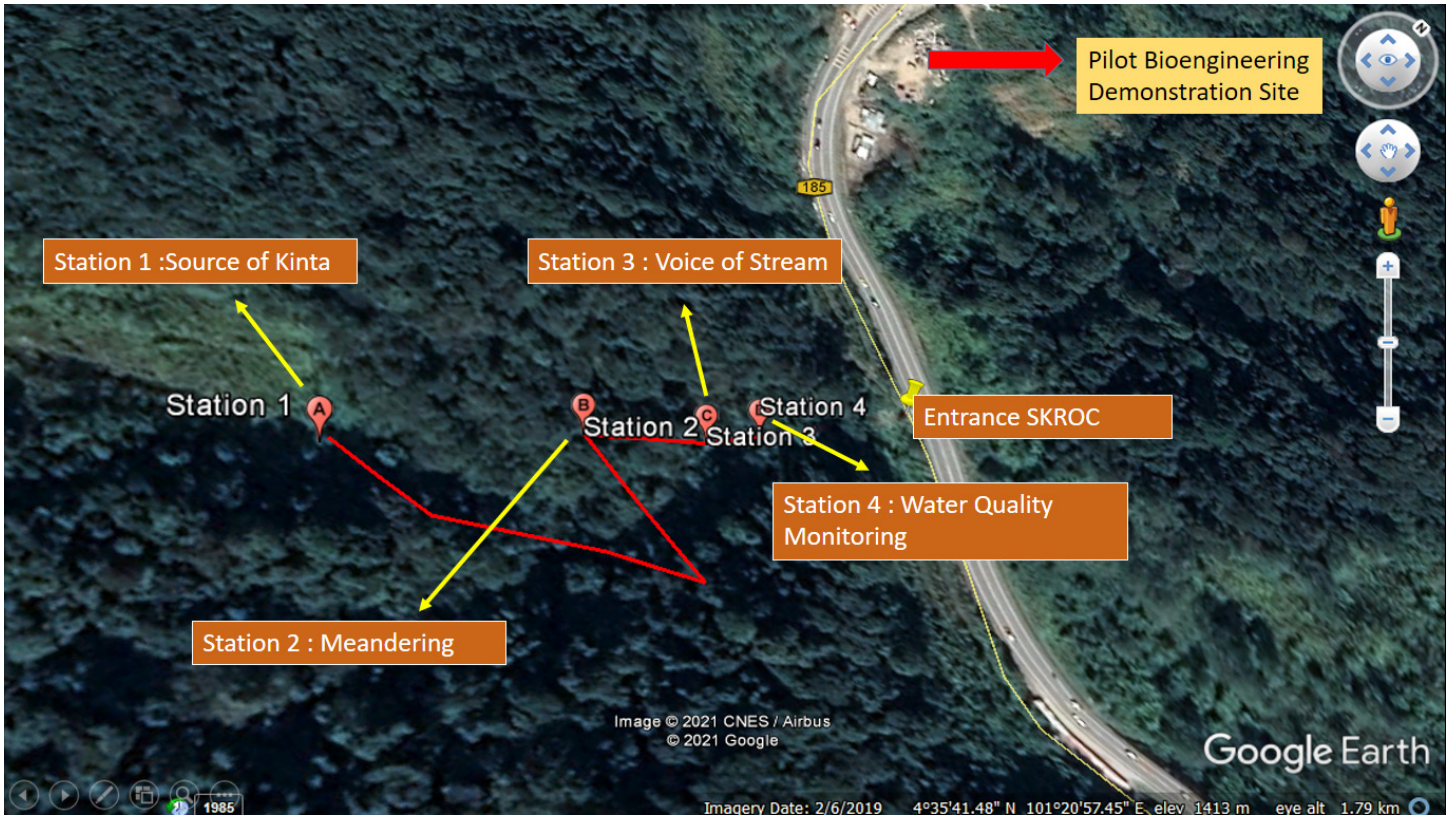
In Malaysia, GEC mooted the idea of setting up River Open Classroom. River Open Classroom usually set up to amplify hands-on learning hands-on learning on river and river management with surrounding environment as a source of knowledge and also a long term observation site which can be utilised by the public. The outdoor classroom will become a prime area to enhance social and technical skills as well. It will be the hands-on activities spot which will provide opportunities, such as to see the beginning of river journey (water drops), water monitoring, bio-monitoring and river mapping as well as to experience natural and human-created characteristics of the environment in a natural and build-in setting.

In total, a total of 4 River Open Classrooms have been established by GEC in partnership with JPS and other stakeholders. The first River Open Classroom was established at Bukit Kiara in 2004 while others are located at Taman Warisan, Taman Tugu and Urban Community Forest, Malaysia Nature Society Headquarter which is the latest addition in 2018 under ROLPOP Phase 5 project.

In Perak, although we do have River Education Centre in Buntong under W.A.T.E.R, but yet on River Open Classroom. Through GEF5 project, Sg. Kinta River Open Classroom established with the aim of source protection at the same time act as experiential classroom for learners on river system.

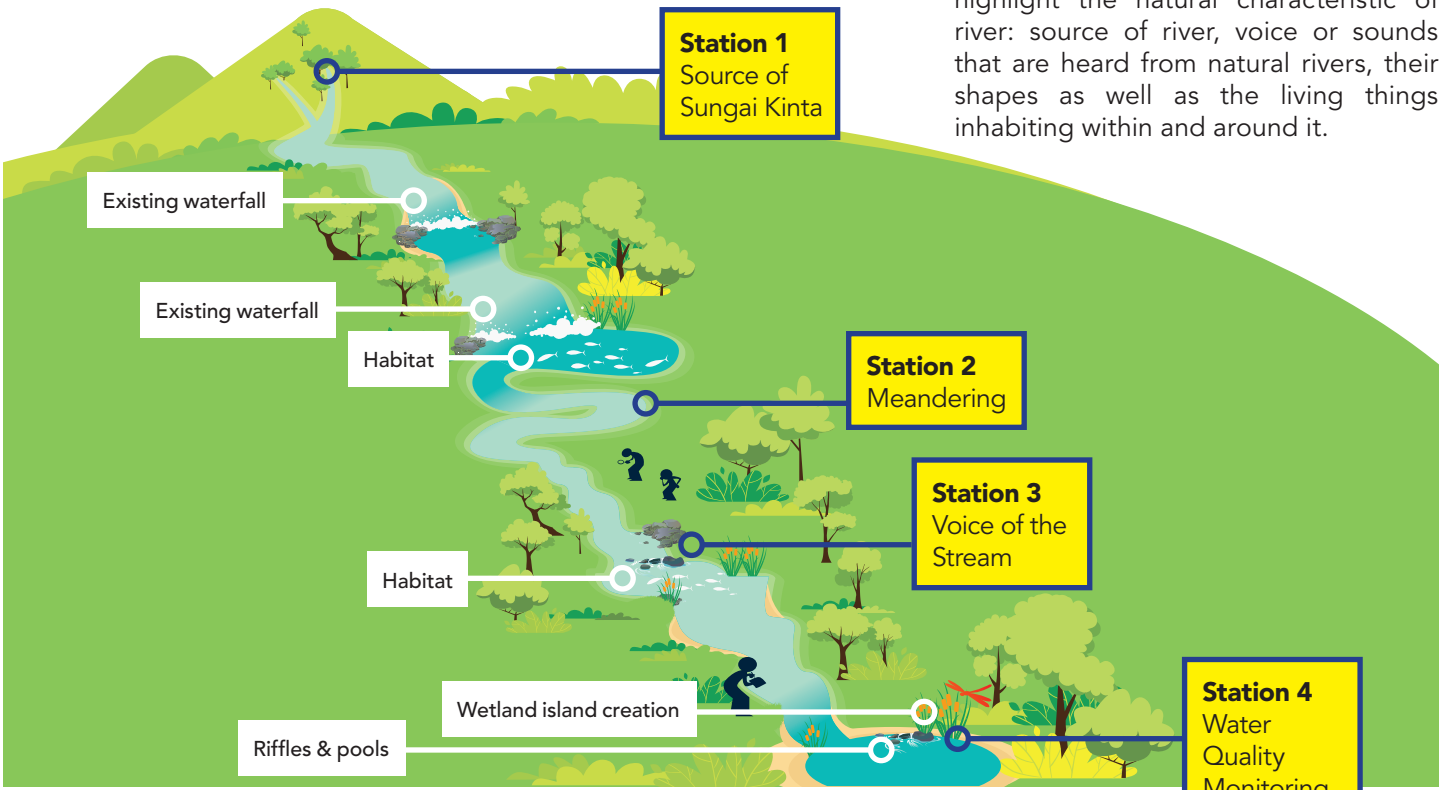
The objectives for Sg. Kinta River Open Classroom establishment are:

- To provide practical training classroom for stakeholders and public;
- To protect and preserve the source of Sungai Kinta;
- To enhance existing river health of source; and
- To support UKB Education hub establishment.


Pilot Bioengineering Demonstration Site
185
Station 1 :Source of Kinta
Station 3 : Voice of Stream
Station 1
Station 2
Station 3
Station 4
Entrance SKROC
Station 4 : Water Quality Monitoring
Station 2 : Meandering
Image © 2021 CNES / Airbus
© 2021 Google
Google Earth
Imagery Date: 2/6/2019 4°35'41.48" N 101°20'57.45" E elev 1413 m eye alt 1.79 km

RIVER LEARNING STATIONS

Four stations along the River Open Classroom path were set up to provide participants with a river walk experience that begins from its source. Each station highlight the natural characteristic of river: source of river, voice or sounds that are heard from natural rivers, their shapes as well as the living things inhabiting within and around it.



Map is not drawn to scale. Not to be used for navigation.

STATION 1:
SOURCE OF THE RIVER

The rivers that you observe, whether they are big or small bodies of water, long or short in length starts from sources such as lake, marsh, spring, mountain or hills. In Malaysia, our ample rainfall plays a main role starting trickles of water from the mountains/hills and slowly flowing down steep areas, bit by bit, forming stream/rivulet and larger flowing bodies of water we call rivers. At Station 1, try your best to uncover the trickle of water that forms the River Open Classroom stream, which is the source of the Sungai Kinta that eventually flows into the Kinta River!

Interesting Facts:

- **Most rivers start off as a little stream. Lots of small streams end up meeting and then become a river!**
- **Some rivers are fed from underground water sources that are released on the surface. These underground water sources are called springs.**

STATION 2:
MEANDERING

Although this is a feature seen throughout the River Open Classroom, Station 2 particularly highlights the importance of meanders. Meanders are the bends or curves in the shape of a river. Meanders are formed when flowing water is obstructed by land where it erodes the outer banks and form a wider path or new path. Meanders are an important feature in river ecosystems in relation to its water retention.

Interesting Facts:

- **Living river should have meanders.**
- **Channelisation is opposite to natural meandering.**

STATION 3:
VOICE OF THE STREAM

Rivers and streams in natural settings have soothing sounds from the flowing water which people find it to be relaxing and one of the good aesthetic values. This natural 'sound' from the flowing water is called the "voice of the stream" signifying the rivers being a living entity and having their own 'voices'. Are the 'voices' produced from the water itself? Does water have sound?

Interesting Facts:

- **Rocks and stones act as vocal cords to create the voice of the stream.**
- **Voice of the stream can be used to indicate the health of river.**

STATION 4:
WATER QUALITY MONITORING

Can be conducted through RIVER Ranger 2.0 programme.

Physical monitoring (using 9 categories to evaluate the river using physical senses)

Chemical monitoring (the most accurate and reliable testing method which involves physicochemical parameters to evaluate river water quality) and

Biological monitoring (a traditional yet interesting way of evaluating river health based on the diversity of benthic macroinvertebrates).

Interesting Facts:

- **Physical monitoring will vary depending on viewers' observation.**
- **Benthic macroinvertebrates used to assess short term environmental variations.**

AQUATIC FAUNA GUIDE

BENTHIC MACROINVERTEBRATES

- Type of animal without any backbones (includes insects, molluscs, crustaceans and annelids).
- Live underwater in the streams and rivers, and can be seen by the naked eye.
- Their diversity and sensitivity to pollution can determine the stream or river's health. Water quality is important to aquatic insects because they breed and live in water.
- Can be calculate using Biological Water Quality Index (BWQI).
- Their presence in the water are good biological indicators to the water conditions because they are:
  - > Sensitive species cannot survive in changed stream conditions such as the introduction of pollution, high levels of sediments, high water temperatures, or low levels of dissolved oxygen (environmental stressors). Tolerant species can.
  - > More likely to remain in a small area for most of their lives.

BIOLOGICAL WATER QUALITY INDEX (BWQI)

(Source: GEC Biomonitoring booklet)

There are many ways to calculate the biological richness of our waterways. One of it is Biological Water Quality Index (BWQI). This method uses a simple scoring system for each animal based on their sensitivity to polluted water. With indicators that fall under four categories (**very sensitive, sensitive, moderate and tolerant**) and non-indicators.

HOW TO CALCULATE BWQI

1. Find any macroinvertebrates using either one of these methods:

   - **PEEK-A-BOO**
   - Look for medium sized rocks/boulder/leaf and gently pick it up to search their bottom.
   - Observe for any movements or try trickling some water over the rocks to find any macroinvertebrate.

   - **SIFT AWAY!**
   - Use a plastic, fine sieve to dig up sand in the river.
   - Lift the sieve up and gently sift through the sands to find any macroinvertebrates.

   - **WHAT'S IN THE NET?**
   - Put your net in and face against the water flow to catch any swimming organisms; or
   - Hold your net just above the riverbed. Kick up some of the sand in front of your net and then lift up the net to see if anything caught.

2. Identify the macroinvertebrates found by referring to the *RIVER Ranger 2.0: River Care Action Guidebook*.

3. Cross-check and record the scores of each macroinvertebrates species and the amount of each type found.

4. Each score represent different types of water quality.

5. Total up the scores of all macroinvertebrates species and divides the total scores by total number of species to get the final score.

Table 1: Example of BWQI Calculation

Species	Individuals	Scores
River prawn	2	8
River crab	2	3
Mayfly (Nymph)	1	10
TOTAL	**5**	**21**
BWQI (Biological Water Quality Index):		Total Scores ÷ Total Number of Species = 21/3 **= 7**

6. Compare the final scores with the water quality categories as shown in Table 2.

Table 2: BWQI scores with their respective water quality

BWQI	Water Quality
7.6 - 10	Very clean water
5.1 - 7.5	Rather clean – clean water
2.6 - 5.0	Rather dirty water – average water
1.0 - 2.5	Dirty water
0.0 - 0.9	Very dirty water

BENTHIC MACROINVERTEBRATES EXAMPLES

MAYFLY (LARVAE)

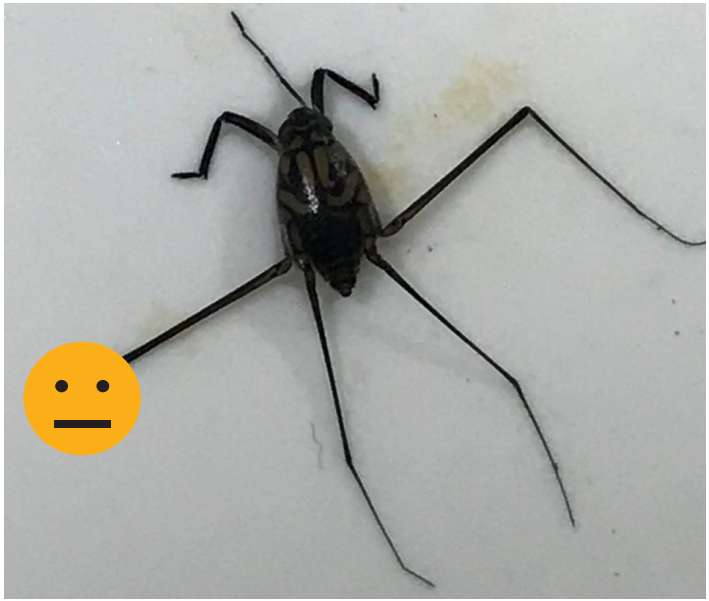
Found in freshwater river, may burrow in the sediment.

BWQI SCORE: 10
(EXCELLENT WATER QUALITY)

COMMON DRAGONFLY (NYMPHS)

Found in freshwater rivers, streams around aquatic vegetation and crawl on the bottom, may burrow into the sediments.

BWQI SCORE: 6
(GOOD WATER QUALITY)



POND SKATER

The common pond skater is found in ponds, streams, rivers, and lakes. It is easily recognizable as it darts about on the water's surface.

BWQI SCORE: 5
(AVERAGE WATER QUALITY)

ONE-TAILED DRAGONFLY

Can be found in common near clumps of aquatic vegetation or submerged tree roots. In still water, algae sometimes grows on their backs.

BWQI SCORE: 4
(AVERAGE WATER QUALITY)

FRESH-WATER HOGLOUSE

Can found in freshwater. They prefer stagnant water, ponds and slow-moving rivers. Here they scuttle around over the weed and under the debris at the bottom.

BWQI SCORE: 4
(AVERAGE WATER QUALITY)

RIVER CRAB

Found in freshwater river, often in lush vegetation near the river bank.

BWQI SCORE: 3
(AVERAGE WATER QUALITY)

APPENDIX

WETLAND PLANTS

In general, the most significant functions of wetland plants in water purification are the physical effects brought by the presence of the plants.

These plants provide a huge surface area for attachment and growth of microbes. The physical components of the plants stabilize the surface of the beds, slow down the water flow thus assist in sediment settling as well as trapping process and finally increasing water transparency.

Wetland plants play a vital role in the removal and retention of nutrients and help in preventing the eutrophication of wetlands. For instance, water hyacinth (*Eichhornia crassipes*) and duckweed (*Lemna minor*) are common floating aquatic plants which have shown their ability to reduce concentrations of BOD, TSS and Total Phosphorus and Total Nitrogen. The Common Reed (*Phragmites* spp.) and Cattail (*Typha* spp.) play a vital role in the removal and retention of nutrients.

Type	Common name	Scientific name
Floating plant	Water gentian	*Nymphoides indica*
	Water mimosa	*Neptunia oleracea*
	White primrose	*Ludwigia adscendens*
	Water lily	*Nymphaea nouchali*
	Water hyacinth	*Eichhornia crassipes*
	Common duckweed	*Lemna minor*
Emergent plants	Tube sedge	*Lepironia articulate*
	Phragmites karka	*Common reed*
	Scirpus mucronatus	*Bog bulrush*
Marsh	Spike rush	*Eleocharis dulcis*
	Greater club rush	*Scirpus grossus*
	Typha angustifolia	*Cattail*
	Common Hanguana	*Hanguana malayana*
Shallow marsh	Fan grass	*Phylidrum lanuginosum*
	Sumatran scleria	*Scleria sumatrensis*
	Golden beak sedge	*Rhynscospora corymbosa*
	Spike rush	*Eleocharis variegate*
	Asiatic pipewort	*Eriocaulan longifolium*
Submerged plants	Water trumpet	*Cryptocaryne cordata*
	Common bladderwort	*Utricularia bifida*

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JABATAN PENGAIRAN DAN SALIRAN PERAK

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