



Sungai Gabai Hulu Langat



# A Handbook On Urban River Management Through Local Community Participation

A project by



In partnership with




With the support of :





# **A Handbook On Urban River Management Through Local Community Participation**



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GAB Foundation and Global Environment Centre (GEC)

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## MINISTER OF NATURAL RESOURCES AND ENVIRONMENT MALAYSIA

### MESSAGE

**W**ater is the essence of life. The main source of drinking water in Malaysia comes from rivers and this will remain so for a long time to come. In the coming years, the water supply situation in the country may change from relative abundance to scarcity. Population growth, urbanisation, industrialisation and agriculture development are increasing the demand for water and exerting pressure on the nation's water resources, besides contributing to water pollution. The potential impact of climate change on our water resources could further worsen the situation.

Therefore, sustainable and integrated management of rivers and other water resources becomes a critical challenge. Our vision for water in the 21<sup>st</sup> century is to conserve and manage the country's water resources to ensure adequate and safe water for all. One way towards creating a sustainable future is to keep development at a level that is within the carrying capacity of the river basins while protecting and conserving the environment. In order to achieve this, we need the support of all stakeholders. The Government encourages the participation of the private sector, community-based organisations (CBOs), non-governmental organisations (NGOs) and local communities in the planning, design, implementation and evaluation of water-related projects.

I congratulate GAB Foundation for its support in initiating the W.A.T.E.R. Project in partnership with Global Environment Centre. Through this project, various Government agencies, including the Ministry of Natural Resources and Environment as well as the local community are working together to rehabilitate Sungai Way.

A "Handbook On Urban River Management Through Local Community Participation" is the result of the knowledge and experience gained through the W.A.T.E.R. Project. I believe this Handbook will provide useful guidance on how to establish better cooperation between the Government and water corporations, water authorities, water companies, consultants, industries, businesses, NGOs and the rakyat. Water is indeed everybody's business and we should all endeavour to make every drop count.

A handwritten signature in black ink, appearing to be 'Douglas Uggah Embas', written over a light blue rectangular background.

**DATO' SRI DOUGLAS UGGAH EMBAS**



## **DIRECTOR-GENERAL OF DEPARTMENT OF IRRIGATION AND DRAINAGE MALAYSIA**

### **MESSAGE**

**I**n this new millennium, water is becoming a scarce commodity in many parts of the world. The lack of clean water is a growing problem and is bound to become increasingly serious as the world's population reaches a projected 9 billion within the next 30 years.

Water is a global issue that has been incorporated into the human rights agenda of the United Nations in order to ensure that the rights to access water resources are protected. No one disputes the fundamental right of every person to have access to clean and safe water. Interestingly, the global water crisis is not so much about having too little water to satisfy our needs but rather about poor water management resulting in billions of people and the environment suffering as a result.

In Malaysia, issues related to water resources have grown in magnitude and complexity especially over the last 20 years. This can be attributed to the shift of the Malaysian economy from agriculture in the 1970s to industrialisation in the 1990s. In our pursuit of development, we often neglect the negative impacts that we have brought upon our rivers and water bodies.

Many of our water catchment areas have been cleared for development and this has led to damage and pollution of our waterways. Millions of our tax payers' ringgit have been spent to finance river cleanup and rehabilitation programmes, but still our rivers continue to face problems of water pollution and environmental deterioration.

The "One State One River" programme undertaken by the Department of Irrigation and Drainage Malaysia since 2005 is targeted at restoring selected rivers in each state of the country to a water quality level of Class IIB of the National Water Quality Standards by the year 2015 whereby body contact with the river water is permissible.

It is time that we realise that the management of water resources is our collective responsibility. This "Handbook On Urban River Management Through Local Community Participation" outlines the roles stakeholders must play in protecting and conserving our water resources. The Handbook will complement the efforts of the Department of Irrigation and Drainage as well as the Department of Environment in ensuring that our rivers and water bodies are clean and safe and sustainably managed for the future.

I wish to thank GAB Foundation and Global Environment Centre for coming out with this extremely useful publication and I believe that it will contribute towards bringing us closer to realising our vision of having clean, living and vibrant rivers in our country.

A handwritten signature in black ink, appearing to be 'HJ. Ahmad Husaini Bin Sulaiman'.

**DATO' IR. HJ. AHMAD HUSAINI BIN SULAIMAN**



## DIRECTOR OF GLOBAL ENVIRONMENT CENTRE

### MESSAGE

**W**ater is the source of life and rivers are the vessels that channel it through the land. Without clean water and vibrant rivers, there will be no life. As water is an important resource, we at the Global Environment Centre (GEC) believe everyone needs to be encouraged and supported to participate in the protection and management of water resources and rivers.

GEC has been working to encourage communities to participate in river basin management for more than 10 years. We have also reached out to the private sector to adopt rivers near their place of operation. We were therefore very happy when GAB Foundation initiated the W.A.T.E.R. Project in partnership with GEC.

This "Handbook On Urban River Management Through Local Community Participation" demonstrates that economic achievements can go hand in hand with environmental achievements. The project would not be successful without the involvement of corporate leaders, policy makers, environmentalists, and ordinary citizens who have risen above the challenges and made the best of opportunities and resources towards advancing sustainable development.

Apart from emphasising the significance of building smart partnerships among all sectors of society for securing our common future, the Handbook documents best practices and lessons learnt, thereby functioning as a teaching tool or guide for target audiences interested in managing natural resources responsibly. It is my sincere hope that such co-managed natural resources initiatives on the ground will become a commonplace in the future.

Finally I would like to thank GAB Foundation again for initiating the project in partnership with GEC.

A handwritten signature in black ink, appearing to be 'Faizal Parish'.

FAIZAL PARISH







## CHAIRMAN OF GAB FOUNDATION

### FOREWORD

I am very pleased to have been a part of the creation of this “Handbook On Urban River Management Through Local Community Participation”, which is designed to provide guidance for communities who have a desire to protect and restore local water bodies in Malaysia. The primary objective of the Handbook is to guide local community watch groups to develop local action programmes and activities to monitor and manage the water quality and biodiversity of local streams and ponds in their backyards in collaboration with the relevant government agencies and the private sector. The Handbook will enhance the capacity of community groups to enable them to respond better to current and future stream and pond environmental issues.

Most streams and rivers, especially in the developing world, are polluted from source to estuary. We can be a solution to the problem by playing an active role in protecting, conserving and restoring our water bodies not only for the sake of our own health but for the well-being of the ecosystem itself which we depend on for our survival as a species.

This Handbook is a timely guide towards better, more efficient management of our rivers, which in turn will ensure a good supply of clean water for generations to come. It is hoped that this Handbook will help to empower you to take action and become stewards of rivers and its aquatic life and be guardians of wetlands of the world.

The Foundation’s objectives are to fund and support corporate social responsibility initiatives that enrich the community focusing on three core areas - environmental conservation, education and community development. Within these key areas, the Foundation strives to identify causes that not only contribute significantly to improving and enriching the lives of deserving Malaysian individuals and communities, but also resonate with GAB’s corporate values of striving for excellence, acting with integrity and having a genuine respect for people, society and its diversity.

Finally, I would like to thank my colleagues in GAB Foundation and Global Environment Centre for developing this Handbook and to the other stakeholders, mainly the Department of Irrigation and Drainage, Petaling Jaya City Council, Selangor Water Management Authority, Department of Environment and the Sungai Way communities for their support and contribution.

A handwritten signature in black ink, appearing to read 'Saw Huat Lye'. The signature is stylized and cursive.

TAN SRI SAW HUAT LYE

# Introduction

## The W.A.T.E.R. Project

W.A.T.E.R. (Working Actively Through Education and Rehabilitation) Project is a pioneer initiative by GAB Foundation, in partnership with the Global Environment Centre (GEC), to educate the public about the importance of water and why and how we should conserve and protect its source: rivers.

The River Rehabilitation Programme is an initiative under the W.A.T.E.R. Project. This 3-year programme focuses on Sungai Way, a tributary of Sungai Pencala, which eventually flows into Sungai Klang. Its water quality has been classified as between Class IV-V (with V being the poorest) and its main sources of pollution are solid and liquid waste from residential, commercial and industrial areas.

The W.A.T.E.R. Project committee decided that its pilot project for river rehabilitation should be Sungai Way as it is in close proximity to the location of GAB's plant and office. This is in line with the Foundation's commitment towards enriching the communities that GAB operates in.

First of its kind, this river rehabilitation project is integrated in its approach and sees close collaboration among key stakeholders comprising government agencies, communities, non-governmental organisations and the corporate sector.

This "Handbook On Urban River Management Through Local Community Participation" was developed as a blueprint for rehabilitating other river basins nationwide.

For more information about the Project, please visit [www.waterproject.net.my](http://www.waterproject.net.my)

## About GAB Foundation

The Foundation's objectives are to fund and support the corporate social responsibility initiatives that enrich the community in which Guinness Anchor Berhad (GAB) operates, by focusing on three core areas - environmental conservation, educational support and community development. Within these areas, the Foundation strives to identify causes that not only contribute significantly to improving and enriching the lives of deserving Malaysian individuals and communities, but also resonate with GAB's corporate values of striving for excellence, acting with integrity and having a genuine respect for people, society and its diversity.

The management and administration of the Foundation is governed by a board of trustees made up of senior members of GAB's management team and independent nominees.

For more information on the GAB Foundation, please visit [www.gabfoundation.org](http://www.gabfoundation.org)





## About The Handbook

The Handbook is a reference document to assist river basin practitioners, professionals and those interested in river rehabilitation. The Handbook documents the lessons learnt during a 3-year urban river rehabilitation project by the GAB Foundation in partnership with GEC and supported by key stakeholders, primarily, the Department of Irrigation and Drainage. The Handbook covers a broad spectrum of activities on river basin management through a partnership approach with government agencies (federal, state and local levels), the private sector, NGOs and local communities.

## Objectives Of The Handbook

- To provide a step-by-step guide on urban river rehabilitation through local community participation in Malaysia.
- To encourage and promote community based river rehabilitation.
- To showcase how to carry out urban river rehabilitation in a collaborative manner that involves working together with government agencies, corporations, NGOs and communities.

## Who Should Read The Handbook

The Handbook will be useful to anyone interested in river rehabilitation and especially to:

- Government agencies handling river basin management that involves local community participation.
- Local communities, CBOs and NGOs interested in initiating a localised river basin rehabilitation work.
- Private sectors interested in and committed to initiating river rehabilitation programmes.

## How To Use The Handbook

The Handbook can be used to develop and implement river rehabilitation initiatives. It provides an overview and summary of issues within the different sub-sectors of Integrated River Basin Management (IRBM), information on the environment and rivers in Malaysia, a case study on rehabilitation of Sungai Way and a step-by-step guide on the execution of river rehabilitation activities.

It is designed to assist any party on how to promote and initiate river basin management through local community participation.



## **CHAPTER 1: The Environment**

# CHAPTER 1: The Environment

## 1.1) WHAT IS THE ENVIRONMENT?

### i) Definition

The environment is formally defined as the “water, air, land, flora and fauna, and any interrelationship between them, as well as any relationship with living organisms.”<sup>1</sup> What does this really mean? When we look outside we see the environment everywhere. Even the things we don’t see, like the air we breathe, the tiny minerals that the soil is composed of and the micro-organisms that help decay the leaves that fall from the trees to make the soil fertile; all this and more make up the environment.

Everything in our surroundings is part of the environment although most people use the word “environment” to refer to the natural world around us.

However, it is a bit more complicated than that. The term “environment” requires us to understand the ways in which all things on Earth, living (biotic) and non-living (abiotic), are actually connected. The study of all these connections is known as ecology. The individual systems that make up the whole natural environment

are known as “ecosystems.” An ecosystem is defined as “a natural unit consisting of all plants, animals and micro-organisms in an area functioning together with all of the non-living physical factors of the environment.”<sup>2</sup> A good example of an ecosystem is a river, plants, animals and insects that live in it as well as all the minerals and compounds that make up the water. The environment makes up anything and everything including humans.

### ii) Our Place in the Environment

Everything that we need for happy, healthy lives comes from the environment. The National Policy on the Environment states that Malaysia’s “growth has unquestionably drawn from nature and its natural resources.” We rely on the environment for the water we drink, the air we breathe, as well as the plants and animals that we consume. So if the environment is in trouble, then we are also in trouble. For example, if the water in our rivers is polluted, then the whole ecosystem suffers. Not only will humans who drink the water suffer, but so will the frogs, fish, insects and water plants. We must take care of our environment so that all living organisms, including our children and their children, can continue to enjoy nature.



*The environment is the natural world in which people, plants and animals live*

<sup>1</sup> Webster's Online Dictionary.(n.d). Retrieved October 07, 2010, from <http://www.websters-onlinedictionary.org/definitionsenvironment?cx=partner-pub-0939450753529744%3Av0qd01-tldq&cof=FORID%3A9&ie=UTF-8&q=environment&sa=Search#922>

<sup>2</sup> Robert W. Christopherson (1996). *Geosystems: An Introduction to Physical Geography*. Prentice Hall Inc.


This idea about caring for our environment is known as “environmental stewardship” and has been around for a long time in many cultures. For example, the RIVER Ranger programme by Global Environment Centre (GEC) establishes a proactive stewardship group to protect rivers. Environmental stewardship is the first principle of the National Policy on the Environment: “Exercise respect and care for the environment in accordance with the highest moral and ethical standards.”<sup>4</sup>

## 1.2) ENVIRONMENTAL ISSUES AROUND THE WORLD

So what are the problems that must be dealt with today, if we wish to protect the environment for the future?

Unfortunately, we have not always done our best when it comes to caring for the environment. Over the last few centuries, we have developed the world to make it a safer and more comfortable place to live in. People have sometimes chosen short-term gains over preserving the long-term health of the environment. In the process we must try to balance three things: “sustainable development”, “economic, social, cultural progress,” and “enhancement of quality of life and the environment.” This is undoubtedly a difficult balancing act!

Many issues plague the environment today. These include extinction of plant and animal species, freshwater shortages, and pollution of air, water and land to name a few. One of the biggest challenges currently being faced by the world’s population is climate change. It is the only global environmental problem that receives the attention of heads of states and governments.<sup>5</sup> Due to rapid development and ever-increasing usage of fossil fuels, the world is now experiencing an unprecedented warming trend that may alter what we think of as “normal” weather patterns. For example, this could lead to some places getting more rain and flooding while others get drier and have more droughts or forest fires. Many scientists around the world believe that climate change can be directly linked to the actions of human beings, and a 2007 report by the International Panel on Climate Change confirmed this.<sup>6</sup>



*If the entire world’s water was to fit into a jug, the fresh water available for our use would only be equal to about one tablespoon.<sup>3</sup>*

<sup>3</sup> National Wild and Scenic Rivers.(n.d).Retrieved March 08, 2010, from <http://www.rivers.gov/waterfacts.html>

<sup>4</sup> Dasar Alam Sekitar Negara. (2002) Ministry of Science, Technology, and the Environment, Malaysia. ISBN 983-9119-82-6

<sup>5</sup> Centre for Environment, Technology and Development Malaysia, CETDEM.(n.d).Retrieved October 07, 2010 from, [http://cetdem.org.my/wordpress/?page\\_id=9](http://cetdem.org.my/wordpress/?page_id=9)

<sup>6</sup> Intergovernmental Panel on Climate Change Report 2007.(2007).Retrieved October 07,2010 from, <http://www.ipcc.ch/>

Coping with climate change may prove to be our defining challenge in the 21st century, and it calls for immediate action.

In addition to climate change, the environment is plagued by many problems caused by humans. Some of the most important issues are the contamination of rivers, streams, lakes, and other waterways by pollutants such as toxic chemicals and fertilizers that are the by-products of large-scale agriculture, industrial production and even widespread use of common household waste. Another problem is deforestation that has led to a serious decline in the number of plants and animals on Earth.

All of these environmental threats, big and small, can have direct and indirect effects on freshwater rivers. But the good news is that it is never too late to make a difference. Everyone can change their lifestyles and get involved to help deal with these challenges.

#### i) Environmental Issues in Malaysia

Many of the environmental challenges are also present here in Malaysia. Some pressing Malaysian environmental issues include “air pollution from industrial

and vehicular emissions, water pollution from industrial, agricultural, residential, sewage, deforestation and smoke/haze from local and neighbouring countries’ forest fires.”<sup>7</sup> According to the World Wide Fund for Nature (WWF Malaysia), “despite a relatively positive environmental record, Malaysia faces problems of deforestation, pollution of inland and marine waters, soil and coastal erosion, overfishing and coral reef destruction, along with air pollution, water pollution and the problem of waste disposal.”<sup>8</sup> Over-logging of tropical forests and replacement with oil palm plantations have drastically altered the amount of habitat available to plants and animals as well as increased the amount of sediment and agrochemicals flowing into fresh waterways and coastal waters.

Here in Malaysia, pollution is a problem like most of the world. According to the Department of Environment’s 2009 Environmental Quality Report, ocean and river water quality has decreased.<sup>9</sup> This is further demonstrated in a statement in the One State One River’s blog by the Department of Irrigation and Drainage (DID) that the number of polluted rivers increased from 48 to 54 in 2008.<sup>10</sup> According to the Department of Environment (DOE), water pollution is caused by both point and non-point sources in



*Illegal logging activities*



*Haze caused by peatland burning*

<sup>7</sup> United States CIA World Factbook.(n.d).Retrieved October 07, 2010, from <http://www.cia.gov/library/publications/the-world-factbook/geos/my.html>

<sup>8</sup> Environmental Problems in Malaysia.(n.d).Retrieved October 07, 2010, from [http://wwf.panda.org/who\\_we\\_are/wwf\\_offices/malaysia/environmental\\_problems\\_malaysia/](http://wwf.panda.org/who_we_are/wwf_offices/malaysia/environmental_problems_malaysia/)

<sup>9</sup> Malaysia Environmental Quality Report 2008. (2009) Department of Environment. ISSN 0127-6433.

<sup>10</sup> Satu Negeri Satu Sungai.(2009). Retrieved October 07, 2010, from [1s1r.blogspot.com](http://1s1r.blogspot.com).

Malaysia. Point sources are specific points of entry for river contaminants such as sewage treatment plants, manufacturing industries and oil mills. Non-point sources are spread out over the whole river basin. Examples include earth work/land clearing and surface runoff water that carries pollution into the water catchments.

Clearly, Malaysia's river basins are in need of rehabilitation. The next chapter will in detail explain the concept of river basins so that we can better understand the threats facing them.



*Drains filled with rubbish – a common scene in most urban areas, have become an environmental problem in Malaysia*







**CHAPTER 2: River & Water**  
**~ The Source Of Life**

## CHAPTER 2: River & Water ~ The Source Of Life

### 2.1) INTRODUCTION

The river connects us all in many different ways. We were once closely associated with rivers as they used to be a key mode of transport and source of food. Today, most of us perceive rivers merely as a place to dump rubbish and other pollutants that can drastically change the quality of our rivers. We have forgotten how important the river is, especially since it is the main source of our drinking water supply.

### 2.2) RIVER

#### 2.2.1) DEFINITION

A river is defined as “a wide, natural stream of fresh water that flows into an ocean or other large bodies of water and is usually fed by smaller streams, called tributaries, that enter it along its course. A river and its tributaries form a river basin, or watershed, that collects the runoff throughout the region and channels it along with erosion of sediments in the river.”<sup>11</sup>



*Aerial view of a natural river*

#### 2.2.2) WHERE DO RIVERS IN MALAYSIA BEGIN?

In Malaysia, we are blessed with an abundance of rainfall every year (990 billion cubic metres). This has been the source of life to our 189 river basins, 150 major river systems, with 100 of them in Peninsular Malaysia and 50 in East Malaysia. These river systems consist of 1800 rivers with a total length of 38,000km.

Rivers in Malaysia often originate from the highlands. The highlands are often referred to as natural “water towers” as a significant amount of water from rainfall is captured and accumulated in forests.



*Source of Pencala River*

Upstream areas of a river are characterised by steep V-shaped valleys, waterfalls, and fast flowing water among boulders and rocks. In the middle, the river winds its way slowly through the flatter land, and continues to widen its channel by meandering and depositing material that is too heavy to carry in the water. As it makes its way out to the sea, its flow reduces and it starts to deposit even more material in and around its own channel. At its mouth, where the river meets

<sup>11</sup> River. (n.d.). *The American Heritage® Science Dictionary*. Retrieved August 01, 2010, from <http://dictionary.reference.com/browse/river>

the sea, there is a sudden drop in velocity, and all the material being carried in the water column is deposited here. As the material builds up from continuous deposition, the mouth of the river gets blocked and the river has to find new outlets into the sea by forming new streams wherever it can. This is the formation process of a delta and is characteristic of all river mouth areas.<sup>12</sup>

However, under certain circumstances, the source of certain rivers in an urban catchment area comes from kitchen waste.

### 2.2.3) THE USAGE OF OUR RIVERS

Rivers in Malaysia have played an important role in the economic, social, cultural and religious aspects of life.



#### **Agriculture**

*In Malaysia, rivers support agricultural development and productivity. The highest percentage of water demand in Malaysia is for irrigation in the agricultural sector.*



#### **Domestic & Industrial Water Supply**

*In Malaysia, 97% of our water supply comes from rivers and streams. The demand for residential and industrial water supply has grown rapidly following the country's economic development, increase in population and urban growth.*



#### **Biodiversity**

*Our rivers are home to a wide range of flora and fauna which live in and around them. As a river journeys from its highland origins to lower areas, plants and animals particularly aquatic life, differ along its seaward course.*



#### **Livelihood**

*Malaysia still has a strong "orang asli" community. These local communities depend on the resources provided by forests and rivers. Local communities usually depend on rivers for fish which is their main diet. Among local species that are found in Malaysian rivers are Baung (*Mystus spp*), Lampan Sungai (*Puntius schwanefeldii*), Jelawat (*Leptobarbus hoeveni*) and Kekutu (*Oxyeleotris marmoratus*). Freshwater prawns and certain aquatic plants are also a major food source derived from rivers.*

<sup>12</sup> World Wide Fund for Nature Malaysia.(2003).Living Rivers.WWF Malaysia.

### **Transportation**

*Some of the remote and interior villages in Sabah, Sarawak, Perak and Pahang depend on rivers for transportation. Here the traditional role of rivers continues even today but on a much smaller scale than before. For some of these remote locations, without alternative modes of transportation and limited access, rivers provide the sole means to remain in touch with the outside world.*

### **Recreational**

*Rivers are widely used as a recreational area. Left in its natural state, rivers and their surrounding forest areas make a great place for picnics, camping and canoeing. They are also used for other sports like white water rafting and fishing competitions. In developed countries that have large rivers flowing through the city centre, these rivers are often used as a tourist attraction to run cruises that provide a scenic tour of the city.*

### **Religion**

*In any religion, water is always considered the purest resource on earth. Rivers are used in numerous ceremonies and festivals. The water from rivers is usually considered pure and the source of life.*

### **Generating Hydropower**

*For the period of 1996 to 2000, hydroelectric power output constituted between 7% to 12% of the total national energy generated annually. It was estimated that 85% of the total hydropower potential of the country can be found in Sabah and Sarawak.<sup>13</sup>*

## 2.2.4) CHARACTERISTICS OF A NATURAL RIVER

A river is a living entity. A river is not merely a channel for water to flow. There are living things that depend on the river for survival, both in the water and on the land that the river supports. The narrow area along a river is called the riparian corridor. This area supports a variety of plants and trees that contribute nutrients, shade, soil stability, habitat, and organic materials for small organisms to eat.

Rivers contain living things such as aquatic plants, fish, crustaceans, and mollusks. These are the stakeholders of rivers. They also support insects and mammals which utilise the river for many purposes.

As such, rivers provide a great variety of habitats and services for all living things and it is important to maintain both physical and biological diversity in and around rivers.

It is important to recognise rivers as a living entity. Without the living things that exist around and within it, the river cannot function as nature intended it to. Therefore, it is important to care for our rivers and ensure that the water quality of our rivers remain in a pristine state.

### **Meanders**

One of the characteristics of a river is that it follows bends; basically it meanders. Why are rivers crooked and why do they meander? Meanders are curves in a stream or river. Rivers meander because that's just the way nature is.

Meanders usually appear wherever a river goes down a gentle slope, flowing around obstructions, through fine-grained soil that easily erodes but sticks together well enough to make firm banks. Obstructions in the land such as trees or firm land, cause the river to bend and find another path. The river begins to hit against the

<sup>13</sup> World Wide Fund for Nature Malaysia. (2003). *Living Rivers*. WWF Malaysia

banks until it erodes and forms a curve.

Meanders are important features of a river because they help to regulate the velocity of the river. As the water winds around the curves, it hits the banks and this slows down the flow of the water. One of the reasons why we experience flash floods in Malaysia, especially in cities such as Kuala Lumpur, is because many of our rivers have been straightened and channelised by concrete banks. Straight rivers mean that the water has no obstructions to slow down its flow, so the water levels can rise very fast.

#### **Riffles & Pools**

Other characteristics of a river or stream are its riffles and pools. A stream can be a challenge for organisms that live in the water. Flowing water can move particles of all sizes and some organisms just need a place of their own. Riffles and pools are essential features that help to provide different micro-habitats for different organisms to live in.

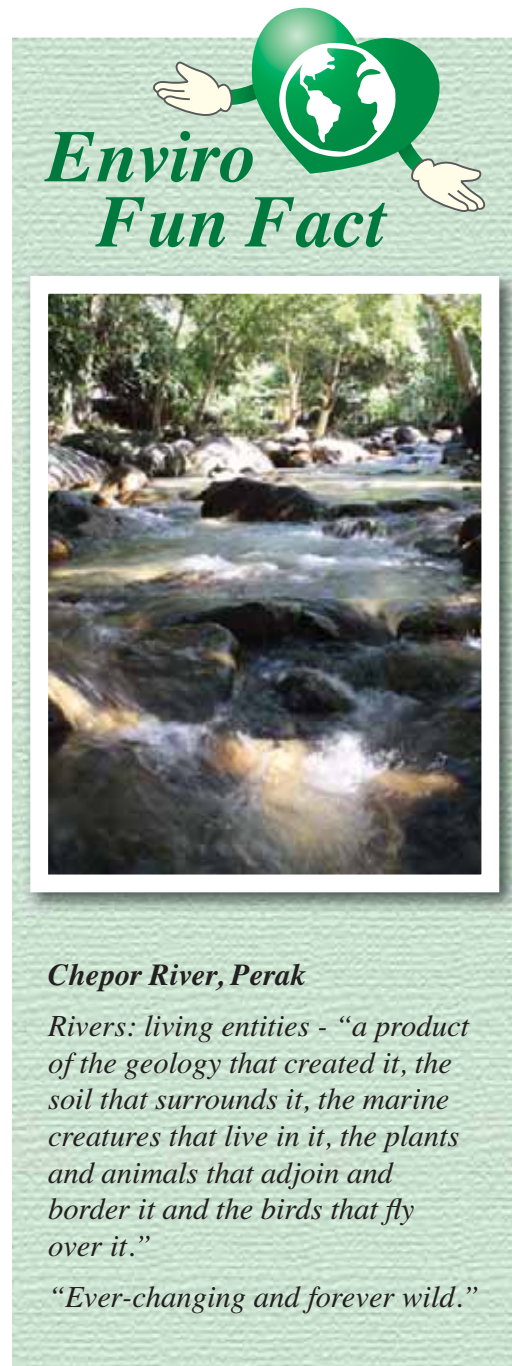
Riffles are areas of fast flowing water where rocks and pebbles cause the water to flow above, around and under them, and in the process oxygenate the water. This also produces sound which becomes the voice of the stream. It also cleans substrates which are then colonised by bacteria and macro-invertebrates. The presence of riffles also causes pools to be formed and these are areas of slow flow. Living organisms in rivers are dependent on these different areas for their own needs; without different velocity gradients, the diversity of organisms will be greatly reduced.

Constructing riffles and runs in degraded channels can restore the variety of flow velocities and micro pools necessary to support aquatic ecosystems.

#### **2.2.5) THREATS TO RIVERS – LIVING ENTITIES**

##### **Pollution**

Pollution is one of the primary threats to our rivers and the main reason why water quality in some of



**Enviro  
Fun Fact**

*Chepor River, Perak*

*Rivers: living entities - “a product of the geology that created it, the soil that surrounds it, the marine creatures that live in it, the plants and animals that adjoin and border it and the birds that fly over it.”*

*“Ever-changing and forever wild.”*

the rivers in Malaysia has declined.

Pollutants may be divided into two types: point source and non-point source.

Point source is usually a pipe that discharges effluents into a receiving water body, e.g. waste water discharges from industrial plants, municipal sewage treatment plants, urban storm sewer discharges, thermal discharges from power plants, animal feeding operations and boat wastes.

Non-point source is caused by human activities. Surface runoff carries them into streams, rivers, lakes, and wetlands, e.g. sediment, nutrients and faecal bacteria.

Point source pollution is much easier to detect than non-point sources which can come from a number of different areas and as such controlling them is complex. Our individual habits and actions contribute to the non-point source pollution in urban runoff. Our lawns, gardens and golf courses contribute nutrients, sediment, and pesticides; pet waste and septic tanks contribute nutrients and fecal bacteria; vehicles contribute petroleum, metals and other toxic residue; and various cleaning solvents, paints, and other household products can result in toxic substances. Not to mention that whatever rubbish carelessly thrown on the ground or in drains also end up in our rivers.

There are three main contributors to pollution – residential, business and agriculture.

### ***Residential (homes/human)***

- *Humans are sometimes careless and throw rubbish such as bottles, plastic bags and cigarette butts among others directly into rivers.*
- *Household sewage, fertilizers, herbicides and pesticides used in gardens can runoff and contaminate the waterways.*
- *Improper disposal of hazardous chemicals into drains introduces toxic materials into the ecosystem, contaminating the water supply in a way that can harm aquatic organisms.*
- *Oil leaks from a car on a driveway can be washed off by the rain into nearby waterways.*
- *Restaurants use drains as their disposal unit. Many dispose waste foods and allow the water from their dish-washing to flow directly into the drain. This ends up in the river.*



*Pollution from residential areas*



*Sedimentation*

### ***Business (industries/factories)***

- *Clearing of land can lead to erosion of soil into the river.*
- *Waste and sewage or dirty water containing chemicals generated by industry can get into water bodies, introducing large organic and chemical pollutants into the ecosystem.*
- *Many industrial and power plants use rivers, streams and lakes to dispose of heat waste or to power/cool down machineries. Changing the temperature of the water in the river is called thermal pollution and has disastrous effects on living things in the river.*
- *Water can become contaminated with toxic or radioactive materials from industries, mine sites and abandoned hazardous waste sites.*
- *Acid rain is caused when the burning of fossil fuels emits sulfur dioxide into the atmosphere. The sulfur dioxide reacts with the water in the atmosphere, creating rainfall which contains sulfuric acid.*



*Pollution from the dairy industry*



*Pollution from commercial areas*



*Oil leaks*

### ***Agriculture (farming)***

- *Farmers put fertilizers and pesticides on their crops so their crops grow better. But these fertilizers and pesticides can be washed away by rain and end up in rivers.*
- *Allowing livestock to graze near water sources often results in organic waste products being washed into waterways.*
- *Exposed soil from agricultural fields can get washed into rivers.*



*Pollution from squatters*



## Effects And Impacts Of River Pollution



### **River**

- Smelly rivers from rotting rubbish and raw sewage.
- Unsightly rivers filled with rubbish.
- Susceptible to algal blooms.
- Loss of its natural functions and beauty.



### **Water**

- Water supply becomes polluted.
- Interrupted water supply and shortages due to water treatment shutdowns caused by pollution.
- Water quality worsens.
- Decline in the amount of clean freshwater available for consumption.



### **Biodiversity**

- Kills plants and animals living around and within the river.
- Loss of species diversity.
- Invasion of alien, tolerant species that will dominate over local species.



### **Human Health/Welfare**

- Polluted river water is sometimes still used for irrigation. Hence, it could have an effect on crops and on human health.
- Quality of life is reduced due to increased health problems from polluted water, unhealthy surroundings, floods and poor management of rivers.
- Rivers become carriers of diseases which will directly and/or indirectly affect us.
- Toxic contaminants like heavy metals, organic compounds, nitrates and micro-organisms from rubbish and industrial pollution can cause acute or chronic toxicity in humans. Fatality may follow after exposure or it could cause long-term illness that cannot be detected until fatal symptoms arise.



## 2.2.6) RIVER CLASSIFICATION BY USE

Rivers in Malaysia can be classified according to a predetermined designated use. Malaysia has established water quality standards that are appropriate for each designated use. When the waters are of sufficient quality to fulfill their classification requirements, they are said to support their classification. Examples of designated use are as follows:

| <b>Usage</b>                       | <b>Classification</b>                                                                                                                                                                                                                                                                  |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Drinking Water</i></b>       | <i>Designated for human consumption; must be fit for drinking, cooking food, and other domestic purposes. Raw water criteria (water before treatment) is dependent upon the technology level at the potable water treatment plant.</i>                                                 |
| <b><i>Industry</i></b>             | <i>May be used by industries such as pulp and paper plants, chemical and steel manufacturers, for processing non-food products and for cooling purposes.</i>                                                                                                                           |
| <b><i>Navigation</i></b>           | <i>Water may be used for the commercial transfer of humans, animals and goods.</i>                                                                                                                                                                                                     |
| <b><i>Livestock</i></b>            | <i>Water may be consumed by livestock and poultry and used for cleaning purposes.</i>                                                                                                                                                                                                  |
| <b><i>Aquatic Life Support</i></b> | <i>Water may be used to maintain the ecological integrity of rivers including the sustained growth and propagation of aquatic organisms (fish, invertebrates, macrophytes and plankton), semi-aquatic organisms, and terrestrial wildlife dependent on surface water for survival.</i> |
| <b><i>Irrigation</i></b>           | <i>Water may be used to supplement rainfall for growing crops.</i>                                                                                                                                                                                                                     |
| <b><i>Fishing</i></b>              | <i>May be used for legal fishing for the purpose of human consumption.</i>                                                                                                                                                                                                             |
| <b><i>Recreation</i></b>           | <i>Usage is divided into two categories; primary and secondary contact. Primary contact refers to body immersion in water, e.g. swimming. Secondary contact refers to body contact with water, e.g. rafting and canoeing.</i>                                                          |

Table 1: Designated use of river water<sup>14</sup>

<sup>14</sup> River Auditing: Let's Get to Know Our Rivers. (2007). Global Environment Centre

### Water Quality Classification

Proper classification is based on National River Water Quality Standards for Malaysia, which consists of five classes.

| Class      | Usage                                                                                                                   |
|------------|-------------------------------------------------------------------------------------------------------------------------|
| <i>I</i>   | <i>Very clean; practically no treatment needed; conservation of natural environment; very sensitive aquatic species</i> |
| <i>II</i>  | <i>Clean but needs treatment before drinking; sensitive aquatic species</i>                                             |
| <i>III</i> | <i>Polluted water and needs extensive treatment before suitable for drinking; recreational use with body contact</i>    |
| <i>IV</i>  | <i>Only used for irrigation</i>                                                                                         |
| <i>V</i>   | <i>Extremely polluted and cannot be used for any purpose</i>                                                            |

Table 2: National River Water Quality Standards <sup>15</sup>

#### 2.2.7) RIVER BASIN

A river basin is the entire area drained by a river including its tributaries. This means, all water in the river basin area drains into the river and its tributaries. Therefore, the flow of water sets the boundaries of a river basin.

Hydrologists sometimes refer to river basins as 'catchments' or 'drainage basins'. The term 'watershed' is used synonymously with river basin, especially in the U.S.

River basins catch precipitation and accumulate water, which flows across or under the landscape. They come in many different shapes and sizes. River basins can be hilly, mountainous, or nearly flat and can comprise many land uses including forests, farms, towns and cities.

#### 2.2.8) INTEGRATED RIVER BASIN MANAGEMENT

Integrated River Basin Management (IRBM) can be defined as a "process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystem". (Global Water Partnership, 2000)

Some of the concepts in IRBM include:

- i) Looking at the management of not just the river, but the entire river basin. This includes all the land and activities within the basin's boundaries.

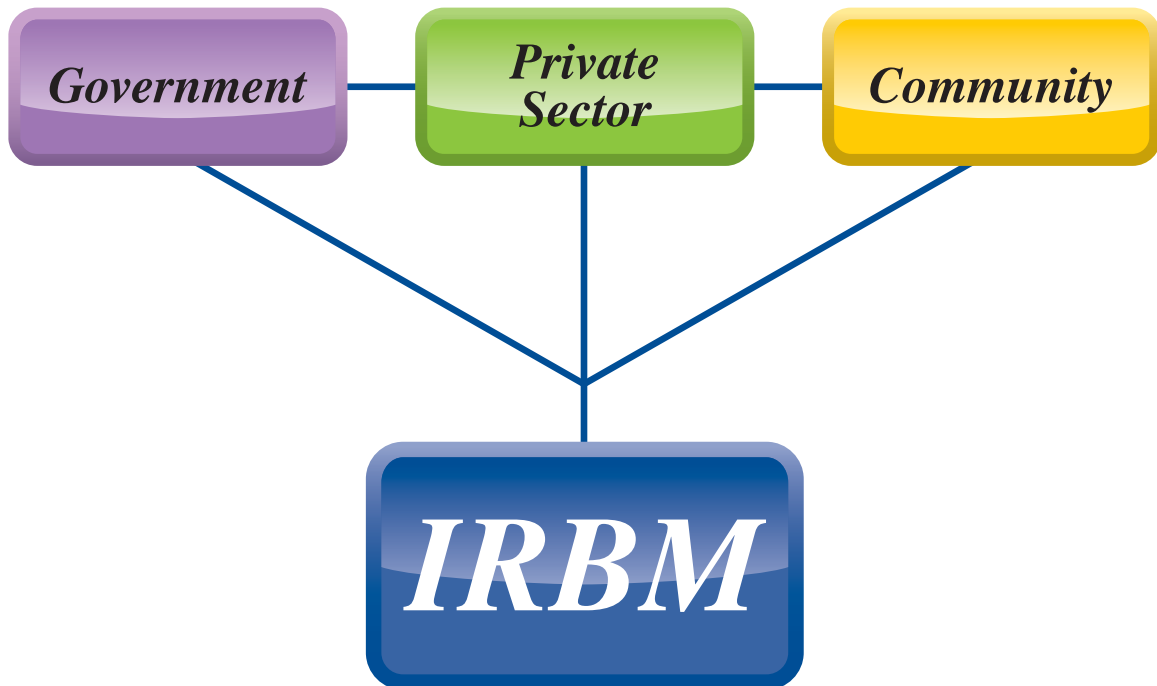
<sup>15</sup> Zulkifli Abdul Rahman.(n.d).Water Quality Management In Malaysia. Retrieved October 07, 2010 from [www.iges.or.jp/jp/ltp/pdf/wwf3/fr2.pdf](http://www.iges.or.jp/jp/ltp/pdf/wwf3/fr2.pdf)

- ii) Involving all stakeholders in river management. This includes inviting private sector companies and the general public to share their views and opinions on projects and to voice their concerns.
- iii) Ensuring proper communication between stakeholders upstream, midstream and downstream of the river basin so that there is no conflict in planning and water resources.
- iv) Having clear guidelines and frameworks for the management of water resources at the federal, state, local and community levels.
- v) Having a task force consisting of various experts in different fields including water supply, drainage, environmental protection, river management and engineering so that river management problems can be tackled in the best possible way.

vi) LUAS played an important role in establishing a task force to monitor rivers in Selangor. The task force is known as Jawatankuasa Pengurusan Lembangan Sungai Selangor (Selangor River Basin Management Committee).

A major cause of the state of rivers in Malaysia today is that the river basins are currently managed in a fragmented way, with enforcement powers in the hands of numerous agencies, and no 'one' owner. Upstream and downstream concerns are not integrated and this has led to haphazard land planning and water resource management. IRBM should be implemented in government policies and laws, and practised by government agencies.

However, the government cannot solve all river management problems on its own. It is essential to gain private sector and community participation and support.



## 2.3) WATER

### 2.3.1) WATER RESOURCES AND USE IN MALAYSIA



*Water wastage*

In Malaysia, rivers provide 97% of our water supply. Of the 189 river basins, 30 of them function as reservoirs which supply the 28 million people living in Malaysia with the clean water that flows through our taps. The average Malaysian gets to enjoy about 5,400 cubic metres of water per capita per year compared to African countries where renewable water is commonly less than 1,000 cubic metres per capita per year.<sup>16</sup>

Water use, linked to high water consumption and wastage, and high non-revenue water (NRW) rates, can undermine the sustainability of our water resources. The Water Sustainability Index showed a decrease from 64% in 1992 to 33% in 2002, a reflection that Malaysia's water resources are rapidly depleting and have not been managed sustainably.<sup>17</sup>

Since the concept of sustainable development arose, the Malaysian government began implementing proactive policies and strategies at different levels from the 7th Malaysia Plan onwards. For example, the Integrated

River Basin Management (subset of IWRM) for water planning and development was introduced in the 9th Malaysia Plan (2006-2010) and National Physical Plan (2006-2020).

Development is not possible without water. Water resources therefore must be managed in a sustainable manner for the advancement of social, economic and environmental development, and the well-being of current and future generations.

There are major issues pertaining to the sustainability of water resources use and development in Malaysia.

### 2.3.2) WATER ISSUES

Water is expected to become a main issue in the 21st century as the vital resource becomes increasingly polluted and scarce. Mismanagement, abuse and general apathy have resulted in water crisis that have caused untold hardships in Malaysia.

#### - Institutional and Legal Issues

There is no single agency in Malaysia entrusted with the overall responsibility of holistic planning and management of water. Too many agencies have jurisdiction over water resources both directly and indirectly. This has led to conflicts in water resources management such as allocation of water rights, flood management, pollution control, catchment protection and so on which are resolved through inter-agency coordination and consultation. At the Federal level, a National Water Resources Council (NWRC) has been set up to pursue a more effective water management, including interstate water transfers.

Ambiguous, redundant or outdated legislations relating to water need to be reviewed in today's context. There is a need for a more comprehensive water law. Enforcement needs to be strengthened to address

<sup>16</sup> Salmah Zakaria; & Rafidah Kassim. (1999). *Proceedings from Sustainable Management of Water Resources in Malaysia – A Review of Practical Options: Issues And Challenges In Integrated River Basin Management*. Malaysia. Global Environment Centre.

<sup>17</sup> World Wide Fund for Nature Malaysia. (n.d). *Water Resources*. In *Sustainable Development Indicators Report by Forum 21 (Chapter 6)*. Retrieved October 08, 2010 from <http://www.wwf.org.my>

water pollution, water abuse and other water related problems. However, the plethora of water legislation focuses on limited aspects of water resources and water supply under the jurisdiction of respective government agencies, thus making enforcement difficult.

#### - Environmental Degradation

##### *Change in Land Use*

The push for development has led to overlogging and development of hill land that can, and has led to excessive soil erosion, landslides, destruction of water catchments, water pollution and downstream flooding.

There are current laws to protect water catchments indirectly such as the Land Conservation Act 1960 (Revised 1989), Land Acquisition Act 1960, and EIA Order 1987 but enforcement needs to be enhanced.

##### *Water Pollution*

Water pollution remains rampant with offenders being factories, farmers and households, and water catchments continue to be destroyed as more forested catchment areas are cleared for development, both legally and illegally.

##### *Organic Water Pollution*

The main sources of organic water pollution are domestic and industrial sewage and effluents from palm oil mills, rubber factories and animal husbandry. Mining operations, housing and road developments, logging and clearing of forests are major causes of high concentrations of suspended sediments in rivers. Organic pollution of water has resulted in environmental problems and adverse impacts on aquatic wildlife.

##### *Household Waste Pollution*

Household refuse which is not collected, burnt or buried, end up in drains and rivers. In Klang Valley, an estimated 80 tons of waste end up in the river system

each day. The water quality of our rivers and pollution control must be addressed immediately as 97% of the total water used originates from rivers.

#### - Water Wastage

Water is often underappreciated since it is extremely cheap, costing the average consumer less than a tenth of what they normally pay for electricity. Consequently, people tend to waste water, a precious and finite resource.

So how do we Malaysians stack up against the rest of the world when it comes to wasting water? Local NGO Water Watch Penang reported that "Malaysians tend to overuse water to the tune of about 300 litres/person/day (LPD). The international standard (recommended by the United Nations) is only about 165 LPD. Singaporeans use about 150 LPD, Thais use 90 litres, while people in India and Africa use 100 LPD and 50 LPD respectively."<sup>18</sup> The total demand for water in Malaysia is about 2,000 billion litres per year.

Where does this waste occur? One place is obvious: the toilet! "On average each person (in Malaysia) flushes the toilet seven to eight times a day, and this results in the daily use of about 70 LPD in a home with conventional toilets. A home with water-efficient toilets needs only 20 LPD or less. This means a savings of 50 LPD or more. Nationwide, this would amount to savings of 1,400 million litres per day. And this does not even take into account savings from using such toilets in public and commercial establishments."<sup>19</sup> Every day we use more water than we need without even thinking about it. Apart from flushing toilets frequently, water is also mostly wasted from frequent bathing, washing of cars and floors, watering plants and other activities – all of which we can reduce.

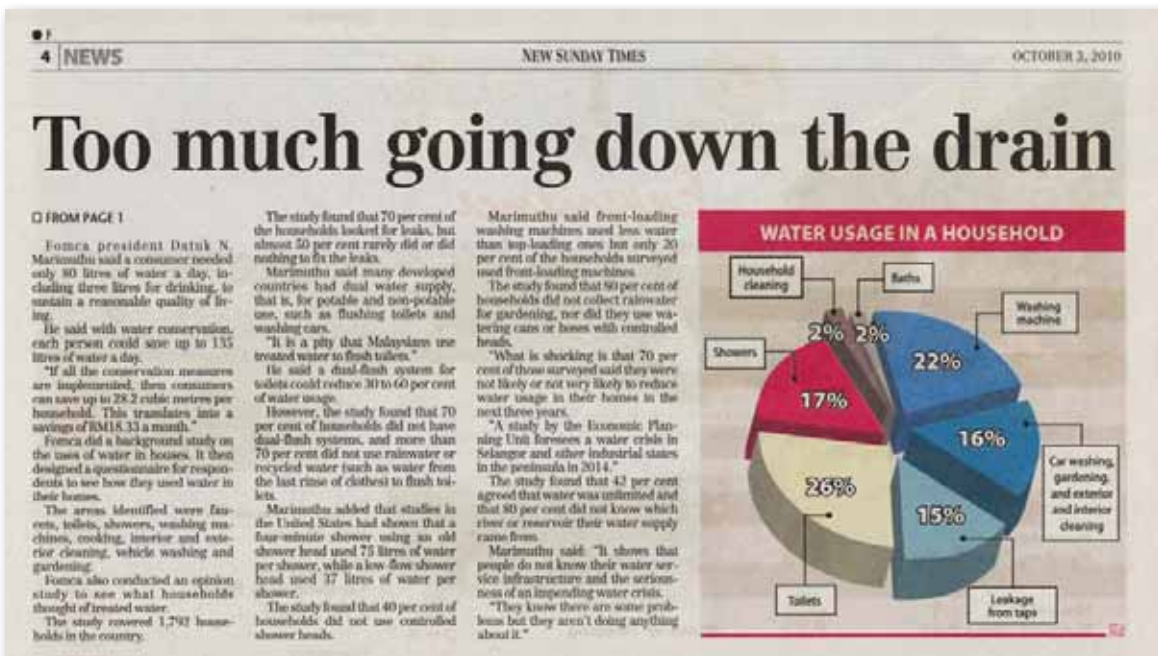
The Domestic Water Consumption Study in 2007 was a joint collaboration between the Federation of

<sup>18</sup> Chan, N.W. (2008, March 20). *Expect more water wastage now that it's free. The Star, Opinion. Retrieved October 08, 2010 from <http://www.waterwatchpenang.org/expect-more-water-wastage-now-that-it-s-free.html>*

<sup>19</sup> Tansen, J.C. (2010, April 27). *Every precious drop counts. The Sun. Retrieved October 08, 2010 from <http://www.waterwatchpenang.org/every-precious-drop-counts.html>*



Article from *New Sunday Times*; October 3, 2010



Article from *New Sunday Times*; October 3, 2010

Malaysian Consumers Associations (FOMCA) and the Ministry of Energy, Green Technology and Water. The study reported that 70% of those surveyed said they were not likely or not very likely to reduce water usage in their homes in the next three years. A consumer needs only 80 litres of water a day, including 3 litres for drinking, to sustain a reasonable quality of living. By conserving water, each person could save up to 135 litres of water a day.

Many developed countries have dual water supply for potable and non-potable use, such as flushing toilets and washing cars. The study also found that 70% of households did not use rain water or recycled water (such as water from the last rinsing of clothes) to flush toilets.

Another study by the Economic Planning Unit foresees a water crisis in Selangor and other industrial states in the peninsular in 2014. The study found that 42% agreed that water was unlimited and 80% did not know which river or reservoir their water supply came from. Clearly people do not know their water service infrastructure and the seriousness of an impending water crisis.<sup>20</sup> The IRBM plan gives us a succinct overview of the systemic problems we face in Malaysia, now and in the coming years. "Rapid development has created gaps in the prevention of pollution and enforcement of water supply standards. There is a need for greater efficiency in water

use, including water re-use for irrigation and improved water management practices and infrastructure. Rapid development in the country has resulted in scarcity of water resources due to increasing demands, worsening impact of floods, increased pollution of the river and diminishing riparian and aquatic biodiversity. Water demands in some states are exceeding the capacity of their resources. This scenario is projected to worsen by 2020 when more states are expected to experience water scarcity with varying degrees of difficulties."<sup>21</sup>

Another report by the DID reinforces this urgent message with some hard figures: "Rapid economic growth in Malaysia in the recent past, coupled with periodic occurrence of prolonged drought has brought the problems of water imbalance into sharper focus, especially where development is concentrated in 'water-stress' regions. There are more people than what a river basin can support in some regions. The 1998 water crisis that hit the Klang Valley is a case in point. Water demand is increasing. Water use by the year 2020 is projected to increase from a current 15.5 BCM to some 20 million BCM."<sup>22</sup> A dire picture indeed.

In conclusion, we as individual Malaysian citizens and communities must get involved and take responsibility for the care of our precious life-supporting river basins, and we must act fast!

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<sup>20</sup> Sonia Ramachandran.(2010, October 3).*Wat-er Waste*. *New Sunday Times*.pp1,pp4col1

<sup>21</sup> *A Blueprint For Integrated River Basin Management In Peninsular Malaysia*.(2006). Retrieved October 08,2010 from [http://www.water.gov.my/images/river\\_section/blueprint.pdf](http://www.water.gov.my/images/river_section/blueprint.pdf)

<sup>22</sup> Keizrul Abdullah.(2007).*Towards Realising Integrated River Basin Management In Malaysia*. In *Integrated River Basin Management Report (Resource Centre)*. Retrieve October 07, 2010 from [http://www.water.gov.my/index.php?option=com\\_content&task=view&id=20&Itemid=300](http://www.water.gov.my/index.php?option=com_content&task=view&id=20&Itemid=300)







**CHAPTER 3: A Case Study On Community  
Participation In The Sungai Way  
Rehabilitation Programme**

## CHAPTER 3: A Case Study On Community Participation In The Sungai Way Rehabilitation Programme

### 3.1) INTRODUCTION

Guinness Anchor Berhad (GAB) is a leading public listed company in Malaysia and started its operations almost 50 years ago. Since its establishment, GAB has proved to be a responsible corporate citizen, maintaining high environmental standards and supporting a range of community-related activities.

To spearhead its corporate social responsibility (CSR) initiatives, GAB set up the GAB Foundation in 2007, to support three focus areas in environmental conservation, education and community development. As a company that relies heavily on clean water for its operations, GAB through its Foundation was keen to embark on a project that would raise awareness on the importance of sustaining the quality of water at its source, the river. GAB Foundation decided to respond to the government's call to help protect Malaysian rivers, and adopted a 2.5km stretch of Sungai Way. Together with Global Environment Centre (GEC), a Malaysian NGO, the W.A.T.E.R. (Working Actively Through Education and Rehabilitation) Project was initiated in early December 2007 in collaboration with relevant government agencies and with support from the local communities along the Sungai Way basin.

The W.A.T.E.R. Project aims to educate the public about the importance of water and why and how we should conserve and protect its source: our rivers.

This 3-year project focuses on Sungai Way, a tributary of Sungai Pencala, which eventually flows into Sungai Klang. Its water quality had been classified as between Class IV-V (Class V indicates worst water quality) and its main sources of pollution were solid and liquid waste from residential, commercial and agricultural

areas. This Handbook aims to provide a working model for community participation in river management so that the same approach and methods can be applied to other river basins nationwide.

### 3.2) OBJECTIVES

The W.A.T.E.R. Project's objectives are to:

- Improve the water quality from between Class IV-V to III-IV and enhance the aesthetic value of the river.
- Increase awareness and inculcate river ownership among communities to help reduce pollution.
- Develop a community participation model for large scale implementation in Malaysia.

### 3.3) PROJECT RATIONALE

Water is a critical resource for consumption and industrial use, in fact it is essential for all forms of life. However, a broad range of water-related problems occur due to improper management and inefficient use of water (and waste water) in the Petaling Jaya area. These include:

- High levels of water usage for domestic and industrial purposes
- Reduction in the quality of water
- Poor conditions of streams and rivers from industrial and domestic pollution, solid waste and soil erosion
- Degradation of lakes and other water bodies
- Development of river corridors
- Flooding
- Lack of recreational areas with clean water resources
- Increase in waterborne diseases

For GAB, water is essential for its operations; it is a key ingredient and used for cooling and cleaning processes. Furthermore, the company's head office is situated in Sungai Way, which is in the lower section of the Pencala River catchment. While GAB has in place a waste water treatment facility which indirectly helps towards maintaining water quality in the Pencala river system, the river water quality around the factory has deteriorated due to pollution from other sources.

These factors propelled GAB Foundation to carry out the W.A.T.E.R. Project as a means to not only help conserve the environment but positively impact the communities around the river.

#### 3.4) PROJECT DESCRIPTION

Sungai Way is situated in Petaling Jaya, Selangor. It is a 2.5km long urban river and 95% of the river has been concrete-channelised (therefore it looks like a monsoon drain). The river begins as two small, separate channels in the SS3 area and converges into one main channel in SS9 just before it flows beneath the Federal Highway. The land is mostly flat and highly developed. Sungai Way flows into Sungai Pencala near the PJS 5 Bandar Sunway area, and about 500m from there, Sungai Pencala flows into Sungai Klang.

# THE SUNGAI WAY BASIN



An evaluation was done on the project site before the W.A.T.E.R. Project commenced. The first and most important step in any project is “to understand the feasibility of the project area”. Based on the survey conducted, the W.A.T.E.R. Project identified at least five communities that were to be involved in the project.

They were categorised as:

- i. Upstream Communities
  - a. SS3
  - b. SS9/9A
- ii. Downstream Communities
  - a. Desa Mentari
  - b. Desa Ria
  - c. Kg Lindungan

Each of the identified areas had its own community representative or one was appointed by the W.A.T.E.R. Project committee. Each community representative or facilitator had to ensure that the local community had sufficient information and knowledge about the project and was proactive. Their main responsibilities were to encourage the community in their area, provide support for the project and implement activities throughout the project's duration.

Little is known about Sungai Way as not much information on its biodiversity and water quality status has been



Community centre in SS9/9A



Sungai Way

gathered. Sungai Way is a typical urban river, which flows through several residential areas and commercial/ industrial areas before ending up in Sungai Pencala. Therefore, it was obvious that the main problems would be from a common pollution source such as:

- a. Domestic waste/discharge
- b. Effluents
- c. Industrial/commercial waste



Domestic waste/rubbish is a main source of pollution in Sungai Way

Sungai Way has also undergone a physical transformation from a natural to permanently concreted and channelised river. As a result, many think it is a drain and cannot believe that it is actually a river. Sungai Way was also found to be not highly diverse in terms of good biodiversity indicators (flora and fauna). Before the project commenced, its water quality tested as being between Class IV-V, indicating a serious river pollution problem.

### 3.5) METHODOLOGY



*W.A.T.E.R. Project Technical Committee meeting*

The W.A.T.E.R. Project aimed to prove the importance of community participation in a river rehabilitation programme. After its implementation, the 3-year project has succeeded in varying degrees. The project's success indicators were measured based on the information gathered from the three components below:

- Community and stakeholder participation
- Activities initiated by both stakeholders and local communities
- Scientific data analysis and conclusion

During the Project's implementation, it came to our attention that various government agencies at state and federal levels are involved in managing the Sungai Way basin. This sometimes led to confusion as to which

activity was carried out under which particular agency. The following basic steps should be followed prior to the implementation of any project activity.



*Training the local community to monitor the water quality of Sungai Way*

1. Project site assessment:
  - a. Geographical information on the site
  - b. Current issues and problems related to pollution
  - c. Targeted local community
2. Consultation:
  - a. Local community  
(public, local leaders, politicians and students)
  - b. Project stakeholders  
(Government, private, NGOs/CBOs)
3. Establishment of a working group:
  - a. Local level  
(community working group)
  - b. Committee level  
(stakeholders' technical committee)
4. Implementation of project activity:
  - a. Activity carried out by local community
  - b. Activity endorsed and carried out by project stakeholders

5. Monitoring:

- a. Observation
- b. Data analysis
- c. Auditing
- d. Reporting

6. Project Evaluation:

- a. Success indicators

### 3.6) THE PROJECT STAKEHOLDERS

It is vital for a community project to have stakeholders' support. However, the project will not be successful if it relies only on the community as a major component to spearhead project implementation. Therefore, the W.A.T.E.R. Project selected stakeholders based on the relevance of each stakeholder and the role they could play in ensuring the sustainability of the project and its success. The following agencies participated in the W.A.T.E.R. Project from the beginning.

- a. Department of Irrigation and Drainage (DID) Selangor and Petaling
- b. Petaling Jaya City Council (MBPJ) through LA21
- c. Selangor Water Management Authority (LUAS)
- d. Department of Environment Selangor (DOE)
- e. Department of Fisheries Selangor (DOF)
- f. National Integration & Unity Department of Selangor (JPN)
- g. Local community representatives

Agencies that participated in the W.A.T.E.R. Project were committed to providing support within their capacity. However, the stakeholders can only work effectively through a working committee. As a result, the W.A.T.E.R. Project established a Technical Committee that was chaired by the District Engineer of DID Petaling. Each of the above agencies was represented in the Technical Committee. The W.A.T.E.R. Project Technical Committee played a significant role in the project implementation phase and ensured the project schedule was on track. The diagram on page 42 shows the organisational structure of the W.A.T.E.R.

Project Technical Committee. Project reporting, activity progress, problems and issues and approval of a new project were discussed at the Technical Committee level. The W.A.T.E.R. Project Technical Committee has the authority to give direction and endorsement to activities implemented under this project. The endorsement is essential in the decision making process of this project. Although it may sound simple, at times it became a very complicated process especially when involving stakeholders with multidisciplinary backgrounds. Each of the agencies had a particular role in this project but roles sometimes overlapped. When this happened it was solved at the Technical Committee meeting. Most importantly it helped the project owner and stakeholders develop a better mutual understanding with each other. Technical Committee meetings were held on a quarterly basis.

Following were the agencies' main roles:

- a. DID: Responsible for managing the river basin, maintaining the river corridor, hydrology and physical condition of the river (Sungai Way).
- b. MBPJ: Responsible for managing the drainage system within the basin, local contractor in charge of rubbish collection, licensing and some land issues. Implementation of LA21 project components (environment and community participation).
- c. LUAS: Responsible for enforcing regulation and laws related to water resources in Selangor. Fully responsible for monitoring the use of water resources for any form of illegal activities which have the potential to pollute and damage these resources in Selangor.



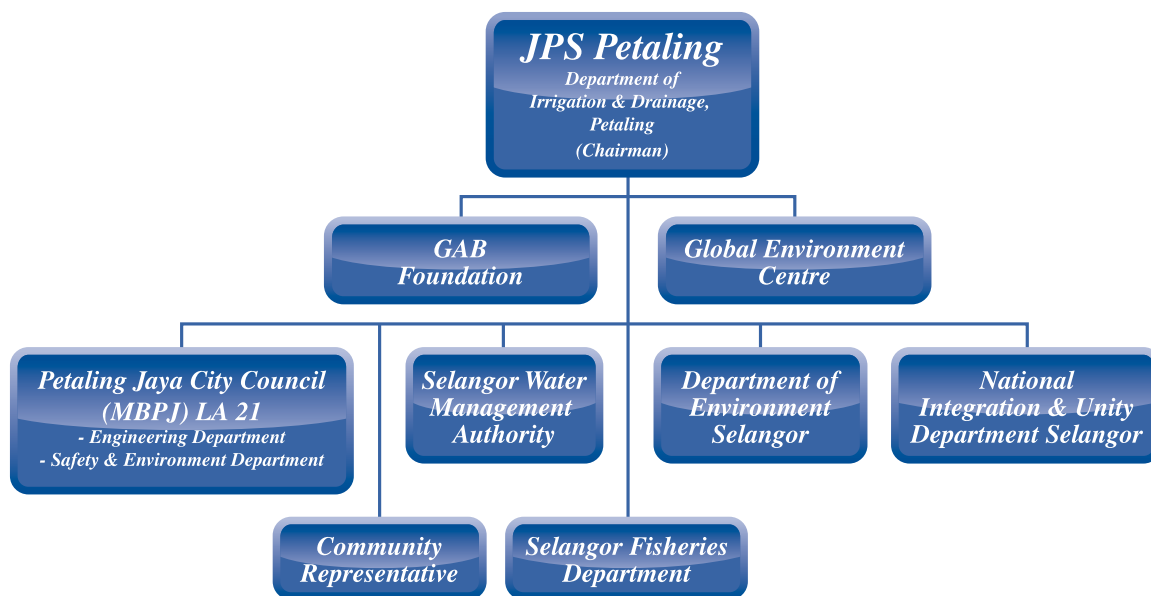
- d. DOE: Responsible for monitoring the rivers' water quality for any type of pollution and enforcing regulations under the Environmental Law accordingly. For this project DOE monitored the activities of all the industrial and commercial sectors along the Sungai Way.
- e. DOF: As the only agency specialising in fish diversity, DOF was asked to lead the Habitat Creation Committee at a later stage when the W.A.T.E.R. Project was prepared to release fish into Sungai Way.
- f. JPIN: An important agency responsible for uniting all races within the Sungai Way basin so that the

local community was able to work together comfortably under the project. Together with the community representatives (RTs), the W.A.T.E.R. Project managed to work closely with the local community.

- g. Local Community: The most important component of the project. Acting as the project backbone, the local community ensured that the W.A.T.E.R. Project was supported by the majority of people living in the Sungai Way basin.

During the three years, the project stakeholders carried out their respective roles well.

Diagram below shows the organisational structure of the W.A.T.E.R. Project Technical Committee.



*All participating agencies were consulted and carefully selected by the project owners before the Project Technical Committee was established.*

### 3.7) ACTION

#### 3.7.1) ENHANCING LOCAL PARTICIPATION

Local communities played a very important role in the W.A.T.E.R. Project. A majority of the identified local community representatives had been long-time residents of Sungai Way and they played a key role in ensuring the project was able to benefit the local community.

Local community facilitators were identified from each of the respective targeted areas: SS3, SS9/9A, Desa Mentari, Desa Ria and Kg Lindungan, and they were supported by an overall facilitator to coordinate all the activities at the local level:

- a. Mr. Ding Eow Chai for SS3/SS9/9A communities
- b. Mr Mohd Zaini Abdullah Thani for Desa Ria and Desa Mentari communities
- c. Mr Zainal Abidin Kamaruzzaman for Kg Lindungan community

The local communities were encouraged to develop their own localised action plans. Seed grants were given to selected local communities to initiate localised programmes in line with the W.A.T.E.R. Project's requirements.



*Training the local community on river monitoring*

The participating communities were also given the opportunity to carry out small scale sub-contract works under the W.A.T.E.R. Project, involving stakeholders. Priority was given to the local community as project stakeholders agreed that the community should benefit from the project. Therefore, several small scale projects were awarded to the local community such as rubbish trap installation, river cleanup and recycling. All these contracts were managed and undertaken by the local community and shared among the groups. So far the approach used has shown significant impact with the local communities becoming increasingly pro-active and the number of participants growing steadily.

Another important factor that has driven local community participation in this project is the acknowledgement and recognition received from relevant authorities. Before the project was introduced, the majority of the people had no knowledge and skills in environmental conservation. Education and training programmes were organised for the community. Some government agencies even invited the local community leaders to demonstrate the skills and knowledge obtained from the project :

- a. DOE – Environmental Camp Bukit Cerakah
- b. MPK – Klang River Carnival
- c. MBPJ – Recycling Talk
- d. LUAS – Used Cooking Oil Collection

The W.A.T.E.R. Project also ensured that events organised by the project stakeholders included the local community. To enhance the participation of the local community, the W.A.T.E.R. Project organised a study tour for them. Three local communities joined the trip to Penang together with the project stakeholders. It was a very successful study tour and the W.A.T.E.R. Project local communities implemented their own 3R programme, composting and garbage enzyme production within their own basin.

### 3.7.2) POLLUTION REDUCTION

Based on the initial findings by the W.A.T.E.R. Project, several steps were taken to reduce the pollution in Sungai Way:

- Point source mapping (identification of point source) along Sungai Way and control implementation plan to minimise pollution discharge into Sungai Way
- Installation of rubbish traps in the river to reduce the amount of rubbish being washed downstream of Sungai Way
- Implementing scheduled solid waste monitoring by the local community to remove unprecedented solid waste in Sungai Way

### 3.7.3) WATER QUALITY IMPROVEMENT

The W.A.T.E.R. Project's main objective was to improve the Sungai Way water quality from between Class IV-V to Class III-IV within three years of project implementation. The project carried out the following initiatives in order to improve the Sungai Way water quality:

- River treatment with effective micro-organism liquid & Mud Ball
- Installation of Food Oil Grease (FOG) traps system at selected food stalls, restaurants and car workshops along Sungai Way. This was mainly to tackle the organic waste and oil discharge into the river
- Wetland cell as biological treatment of the river water

All treatments were undertaken by the W.A.T.E.R. Project and their partners on a regular basis as part of their contribution to support the project's efforts in rehabilitating Sungai Way. The effectiveness of treatments was monitored quarterly through water quality sampling at three identified points (upstream, midstream & downstream). Refer to Appendix 3 for methods to conduct a water quality study.

### 3.7.4) ENHANCEMENT OF RIVER ECOSYSTEM

Usually rehabilitating a river also involves revitalising all the natural living components (flora and fauna) in the river system. The W.A.T.E.R. Project initiated actions to enhance the Sungai Way biodiversity by introducing the following:

#### **River Within River**

The River Within River concept enhanced the biodiversity and transformed Sungai Way from a 'dead' river into a living one. This did not require any massive physical changes to Sungai Way's current condition but just replicating a living river's ecosystem. As a result Sungai Way is once again viewed as a living river rather than a monsoon drain.

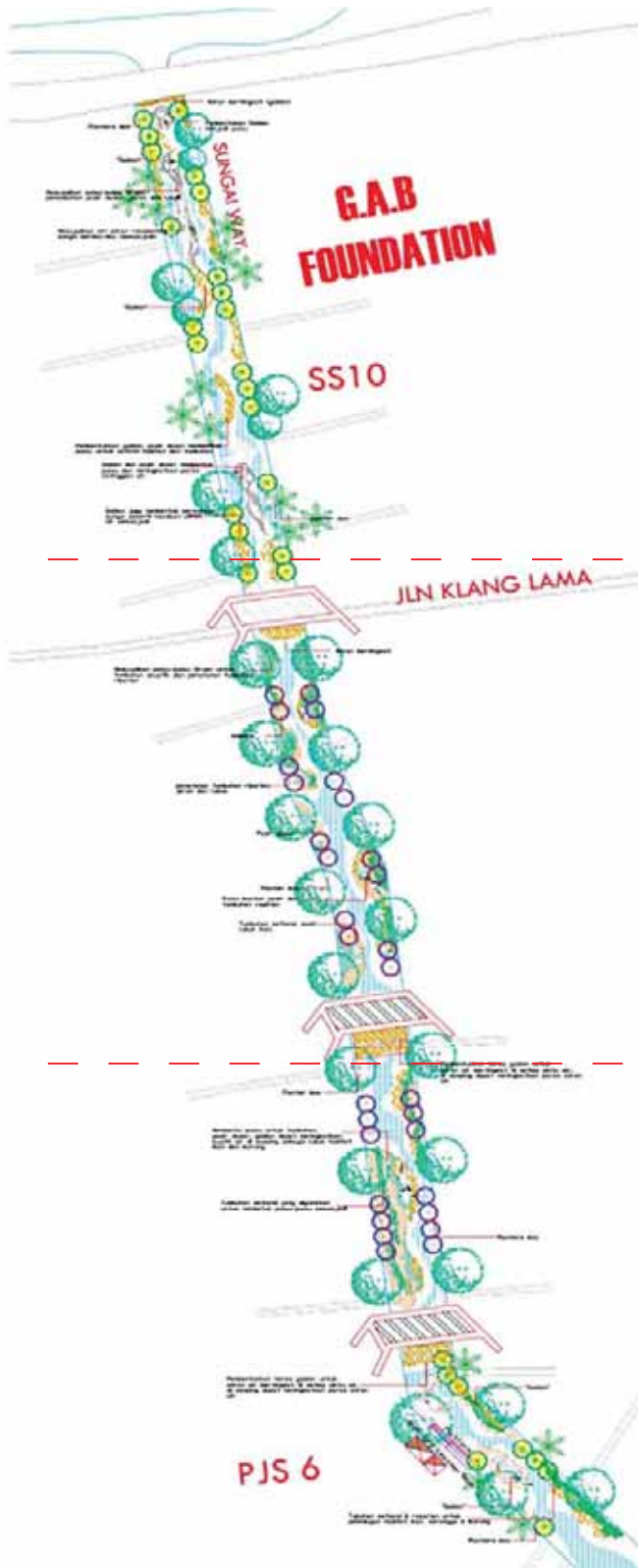
#### **River Beautification**

Suitable tree species were planted along the Sungai Way river bank which is categorised as a common riparian tree species. Wetland plants were also introduced and planted at a number of artificial islands constructed under the River Within River concept. These trees and plants function as habitats for insects and animals besides providing shade for the river.

Refer to Appendix 4 as a guide to conducting a river biodiversity study.

### 3.8) OUTCOMES

Support from both the local community and project stakeholders in the rehabilitation of Sungai Way was crucial for the achievement of the following project outcomes.



Stretch A



Before



After

Stretch B



Before



After

Stretch C



Before



After

### 3.8.1) RIVER ENHANCEMENT: RIVER WITHIN RIVER

The River Within River concept was developed to restore a river closest to a natural living river. Emphasis was placed on the three following areas:

#### a. The Living River

This was implemented at Sungai Way from the stretch next to GAB's head office up to 200m downstream of the river. Several kinds of raw materials such as granite rocks, gabions and gunny sacks were arranged to simulate how a natural living river flows and its ecosystems. A man-made island was constructed and planted with aquatic/wetland plants. Riffles and pools were created by increasing its water base flow level so that deeper parts were created in Sungai Way. Riffles would also create sounds of water ("voice" of the stream).

#### b. Habitat

Sungai Way needed to be restored to a more suitable habitat that supports aquatic life such as fish, invertebrates, and birds to survive and spawn.

#### c. Education and Awareness

The River Within River concept introduced a new element in its implementation where an educational and awareness programme at one of the stretches was established. The aim was to provide accessibility to students and other visitors to experience aquatic life sampling and water quality monitoring.

Each concept has a different function to simulate a living river. The River Within River concept introduced a basic man-made structure which has a lot of natural types of living river ecosystems such as islands, riffles and pools, meanders and aquatic plants. The presence of these man-made structures simulating the real environment of a living river has successfully brought life back to Sungai Way.

Months after the River Within River concept was implemented, Sungai Way began to show signs of a living river. Many invertebrates, fish and birds have been spotted and recorded compared to the time before the River Within River concept was implemented.

### RIVER WITHIN RIVER - BEFORE AND AFTER:



*Stretch B*



*Stretch C*



3.8.2) RIVER CARE EDUCATION CENTRE

The establishment of the River Care Education Centre was the ultimate goal of the W.A.T.E.R. Project as a means to share the river management programme with the public. It was part of a community outreach programme to educate and create awareness among the public who had participated in the project. The centre also targets a wider public including students and children from nearby schools within the basin, so the education programme could be extended to various age groups.



*River Care Education Centre was established to educate and create awareness among the public on the importance of conserving rivers in Malaysia*

The centre marks the success of the W.A.T.E.R. Project in reaching out to the local community after two years of its implementation.

It was also established after realising that awareness and education through scheduled training alone was insufficient to educate the entire community in the basin. The education and awareness programme needed to continue even after the project ends and the only way to effectively ensure this, was through the establishment of the centre, which is accessible to the public at all times.



*River Care Education Centre's facilities*

The centre provides informative tools which can be utilised by the local community to learn about water and river management. It was developed at very minimal cost but is capable of providing the basic needs of education and awareness for those interested in participating in a river management programme. The Sungai Way River Care Education Centre is equipped with an office for day-to-day management, a library for general reading and a mini laboratory for river education.

The official operating hours of the centre are Saturdays and Sundays from 10.00 am to 1.00 pm. However it is also accessible on working days upon request by any interested parties who want to visit or organise training on river management. In addition, the centre is recruiting school students and the public to become library members so they can fully utilise the available reading materials.

Besides GAB Foundation and GEC, other stakeholders have also contributed towards enhancing the centre's facilities. DID Selangor for instance constructed a composting house as a facility for the local community to carry out their ongoing recycling programme, garbage enzyme production, composting and used cooking oil



*Local community members conducting water testing at the centre*

collection activity. To date, the River Care Education Centre has received almost 500 visitors from all over the world including 100 local and foreign journalists, and has conducted more than six training sessions for the public, students and government officials.

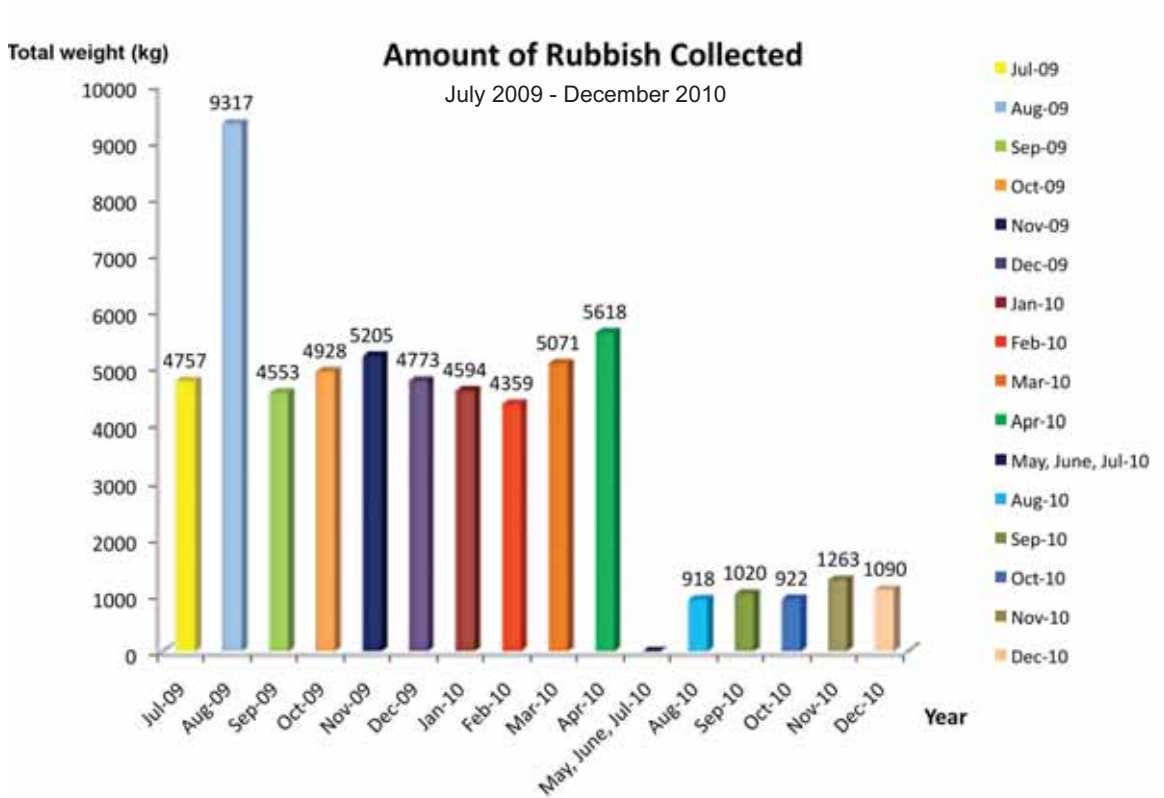


*Rubbish traps were installed to ease collection and removal of rubbish as well as to prevent rubbish from flowing to other rivers/tributaries*

### 3.8.3) RUBBISH REDUCTION

Initiative was taken to reduce solid waste in Sungai Way. Two rubbish traps were installed at upstream and downstream locations – to trap rubbish for easy collection and removal from Sungai Way before the rubbish flowed into Sungai Pencala. The communities are currently monitoring the installed structure and

maintaining the rubbish removal from the traps. The chart below shows the amount of rubbish collected from the trap by the local community.





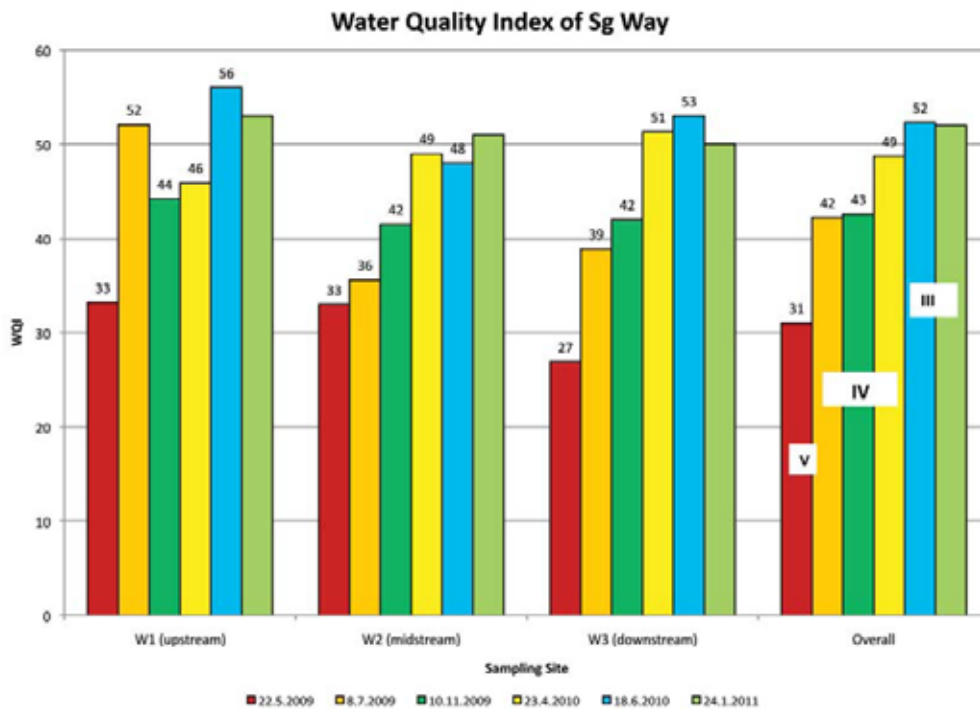
From the chart significant changes in the rubbish collection from Sungai Way can be observed. The bar chart shows a fluctuating trend in the amount collected from Sungai Way and from the traps installed in Sungai Way. Highest reading was observed in August 2009 and this was due to the unusually heavy rainy season. In 2010 another two units were installed at the upstream location and the amount of rubbish collected from both rubbish traps saw a tremendous drop in August 2010 compared to the previous year despite heavy rain. This is also a result of ongoing efforts of the W.A.T.E.R.

Project's awareness and capacity-building programme for the local community. Unfortunately from May to July 2010 there is no record on rubbish collection due to maintenance work on the rubbish traps and River Within River programme.

Based on the findings, it can be concluded that the local community's awareness on this issue has been built and is in line with one of the W.A.T.E.R. Project's ultimate goals.

### 3.8.4) WATER QUALITY IMPROVEMENT

River water quality was monitored by the local community with an independent laboratory engaged to observe the significant changes in the Sungai Way water quality on a quarterly basis. Overall the water quality of Sungai Way has improved from between Class IV – V (for irrigation purpose only) to Class III (needs extensive treatment before suitable for drinking and recreational use with body contact) within the project period. Its water quality improvement is tabled below:



### 3.8.5) COMMUNITY INITIATIVES



*One of the community groups in Sungai Way participating in an environmental exhibition organised by the local government agency*



*Soap produced from used cooking oil*

The local communities also developed their own initiatives as a result of the W.A.T.E.R. Project.

For example, under the W.A.T.E.R. Project, the downstream communities of Desa Mentari, Desa Ria and Kg Lindungan organised a used cooking oil collection and made soap products from this as well as a 3R campaign and composting programme. The SS3, SS9 and SS9A communities organised garbage enzyme, 3R and used cooking oil collection programmes.

These initiatives are still ongoing on a small scale. It is anticipated that this will eventually spread out to the wider community and eventually turn into a source of income for many. In the coming years, Sungai Way is set to experience a significant change when the amount of rubbish collected from the river is reduced in line with the 'Zero Waste Concept'.

### 3.8.6) EDUCATIONAL AND AWARENESS PROGRAMME

#### 3.8.6.1) TRAINING THE COMMUNITY



#### a. Centralised training

All the five communities that participated in this project received training. They were trained on the basic management of river monitoring and water quality sampling. Training was conducted at MBPJ's training hall.

#### b. Small-scale Training and Ongoing Consultation



The importance of ongoing education and awareness is undeniable. This motivated the W.A.T.E.R. Project to organise a second round of community training. Here, the upstream community was trained due to the request made by the wet market traders from the SS3, SS9 and SS9A communities.

### 3.8.6.2) TRAINING FOR BUSINESS COMMUNITY

#### a. Business Partners' Training



Business communities were trained specifically on solid waste management. GAB as the main organiser invited its business partners to participate in the training programme. It was conducted with the support of GEC

in August 2008. The goal of this training programme was to create awareness among business partners on how they can support the W.A.T.E.R. Project by developing a better management plan for solid waste produced within their business premises. Due to the response a second seminar was organised.

#### b. Seminar for Businesses within Sungai Way Basin



The seminar was organised in 2010 and attended by almost 40 representatives from industries and business operators within the Sungai Way basin. The objective of the seminar was to share and showcase the W.A.T.E.R. Project's success and its achievements after two years of implementation. The seminar received a lot of positive feedback from participants including requests to provide training and support for their staff. The W.A.T.E.R. Project's key stakeholders were invited to share their knowledge and present their papers based on related activities of the project.

Key aspects of the dialogue session were documented for others to use as reference and learn about the project's success. Participants were also encouraged to initiate similar programmes in their own basins, with GAB Foundation and the W.A.T.E.R. Project offering their assistance with implementation.



*River bank beautification and landscaping activities*

### 3.8.6.3) RIVER CARNIVAL

Two carnivals were held to encourage the public to participate in conserving the environment and rehabilitating Sungai Way through fun activities and games. This initiative was developed as part of the public education and awareness programme under the W.A.T.E.R. Project. In over two and a half years of its implementation, the W.A.T.E.R. Project successfully organised the River Carnivals for both upstream and downstream communities. The most recent one was held in 2010 at SK Sungei Way. The W.A.T.E.R. Project River Carnival concept is currently being adopted by

many stakeholders as an effective outreach programme on river education and awareness.

### 3.8.7) OTHER INITIATIVES

River bank beautification and landscaping Sungai Way with riparian tree species was done to create shade and a more vibrant ecosystem.

### 3.9) KEY LESSONS

#### 3.9.1) COLLABORATING WITH OTHER GOVERNMENT AGENCIES

Associating a project with any ongoing federal/state/local government initiatives helps to build the project's success.

This particular project managed to establish links with a few ongoing initiatives which resulted in fast and significant outcomes. Ongoing government initiatives that the project worked in collaboration with were:

- Sungai Pencala Rehabilitation Programme by GEC and MBPJ
- One State One River by DID Selangor
- Petaling Jaya Local Agenda 21 Initiatives by MBPJ

#### 3.9.2) STAKEHOLDERS' INVOLVEMENT

It was very important and vital for the project to involve as many committed stakeholders as possible. The project implementer should know how to divide the role of each agency accordingly because overlaps were evident in many cases.

##### Case I

The W.A.T.E.R. Project for example had more than one agency playing similar roles when it came to the management of Sungai Way. Several project stakeholders claimed that Sungai Way was under their jurisdiction. The most obvious case of overlapping jurisdiction was between DID Petaling and MBPJ. In general both agencies have the authority to manage and maintain the river basin system. However, the authorisation to manage Sungai Way might not have been clearly defined at the beginning, and therefore, led to some confusion.

##### Case II

Another similar example under this project were the roles of DOE and LUAS in river management (Sungai

Way). The common perception is that DOE has the authority to prosecute anyone caught polluting the river but as it turned out LUAS also has the right to take action against those caught polluting the river especially in Selangor.

##### Lesson

Both the cases above clearly showed where the stakeholders' involvement could lead to some confusion, especially to the public. The local community, who acted as the eyes and ears of the project, needed to know exactly who to approach to report any illegal activities observed along Sungai Way. The local community was informed about the roles of each stakeholder by the Technical Committee. This shows the importance of having a working group established before the project's implementation stage begins. It is also vital that the role of each stakeholder in the project is specified at the beginning of the project.

#### 3.9.1 COMMUNITY PARTICIPATION

Local community involvement is the most important factor in determining the success of a project of this nature. The local community must be able to provide support for the project at all times. The local community participating in the project needs to produce good results from the activities carried out. The community members who were engaged to monitor Sungai Way and manage the River Care Education Centre showed their commitment to the project by diligently carrying out the initiatives as planned. The W.A.T.E.R. Project received tremendous support from the local community and this was instrumental in achieving the desired results.

##### Lesson

Working with the right community group will ensure the project's success. The project's ability to engage with people of all walks of life at the local community level was another plus point. Thus, their way of thinking about the environment and their perception of Sungai Way changed. The majority of the local community

interviewed said that the W.A.T.E.R. Project was truly an eye-opener. What's more, the community must be provided with the necessary information and skill-set for them to help sustain a project.

### 3.9.2 CHALLENGES

In the first two and a half years of implementation, the W.A.T.E.R. Project faced many challenges and issues which needed immediate attention.

#### 1st Challenge

Obtaining the trust of the local community and project stakeholders on the basis of the W.A.T.E.R. Project being a feasible project that will see results after three years of implementation.

#### 2nd Challenge

Gaining the active support of all project stakeholders as well as the local community of Sungai Way.

#### 3rd Challenge

Dealing with individuals and groups who were reluctant to change their attitude.

#### Lesson

Continuous engagement, education and training will help to instill ownership among the community and see its members continue to be actively involved even after the project officially ends.

### 3.9.3 SUSTAINABILITY OF THE PROJECT

Ensuring the sustainability of the project after it ends is not an easy task. This is very important in order to ensure the local community's interest in the project remains.

#### Lesson

Strengthening the partnership between stakeholders and the local community provided the W.A.T.E.R. Project with various types of support. A smart partnership based on trust can also be a potential source for funding which is much-needed to sustain the project.

### 3.10) CONCLUSION

Based on the outcome, it can be concluded that the implementation of the W.A.T.E.R. Project to rehabilitate Sungai Way was a success. The project has improved the Sungai Way water quality and its biodiversity with tangible and well-documented results. Local community support and interest in the project was strong and a majority of the community are now aware of the project.

Project stakeholders have adopted the W.A.T.E.R. Project as a "showcase". It is truly a shining example of how local communities, the private sector, NGOs and government agencies can work hand in hand to help conserve the environment and positively impact lives.

For further information on the W.A.T.E.R. Project involving the Sungai Way rehabilitation, please visit [www.waterproject.net.my](http://www.waterproject.net.my)





**CHAPTER 4: Managing The River -  
Our Responsibility**



So far, we have learned about our environment and the issues it faces. We have seen how these issues play out around the world and compared that with the situation in Malaysia. In this chapter we will take a look at how rivers are managed. First, we'll see how the government and private corporations contribute to the management of our rivers. Then we'll look at how everyone of us can be involved in river management.

#### 4.1) GOVERNMENT & PRIVATE SECTOR ROLES

##### i) Government's Role

The management of rivers and river basins are fairly complicated with different parties involved. Primarily, Department of Irrigation and Drainage (DID) is the federal agency responsible for river management, and it falls under the Ministry of Natural Resources and Environment. However, as the following assessment by the United Nations shows, river governance in Malaysia is much more complicated.

"States [in Malaysia] are responsible for land use and water resources. Water resource management is becoming increasingly complicated due to inter-state commitments on the production, transfer and sale of water. The federal government plays an advisory role, which may be enhanced with the formation of a National Water Council (NWC). A more comprehensive and detailed monitoring system for catchment areas is needed. The Department of Irrigation and Drainage (DID) is the main agency involved in surface water assessment and the Geological Survey Department assesses groundwater resources, receiving information from the DID. State Water Departments collect information on potable water supply, production, treatment and usage. A network of stations exists for monitoring rainfall and stream flow, with this system being automated progressively."<sup>23</sup>

The Integrated River Basin Management (IRBM) Plan adds this to our understanding of river basin governance: "The management of rivers is largely entrusted to the states according to the constitutional arrangement. Many states still rely on the Waters Act, which is losing relevancy to the issues currently faced. Policies on river management are not entirely uniform across states. Selangor passed the Selangor Waters Management Enactment (1999) and formed LUAS as the central authority to manage water resources and rivers in Selangor."<sup>24</sup>

As we can see from these two objective reviews, we have a long way to go in streamlining the complex process of the government's management of Malaysia's freshwater resources.

##### ii) Private Sector's Role

Besides state and federal agencies, the private sector can play a key role in river management. The IRBM Plan lists private sector participation as one of its best practice principles.<sup>25</sup> The private sector in Malaysia is composed of businesses and corporations that operate for a profit. They may have many different goals, missions and structures not necessarily related to the environment or water issues. However, all can play a role in helping to manage our rivers. This is primarily achieved by partnering with the government or NGOs to help implement specific programmes by contributing the funds needed to set these programmes in motion. Some businesses are directly involved in construction and development projects that can negatively impact waterways. These companies are required to "adopt Best Management Practices for all types of development such as Erosion and Sediment Control Plan to control erosion and sediment"<sup>26</sup> that pollute our rivers and damage wildlife habitat.

<sup>23</sup> United Nations Sustainable Development. (1997). *Natural Resource Aspects of Sustainable Development in Malaysia*. Retrieved October 08, 2010 from <http://www.un.org/esa/agenda21/natlinfo/countr/malaysia/natur.htm#freshw>

<sup>24</sup> A Blueprint for Integrated River Basin Management in Peninsular Malaysia. (2006). Retrieved October 08, 2010 from [http://www.water.gov.my/images/river\\_section/blueprint.pdf](http://www.water.gov.my/images/river_section/blueprint.pdf)

<sup>25</sup> Jabatan Pengaliran dan Saliran Malaysia. (2010). *One State, One River Programme*. Retrieved August 07, 2010 from [http://www.water.gov.my/index.php?option=com\\_content&task=view&id=16&Itemid=395](http://www.water.gov.my/index.php?option=com_content&task=view&id=16&Itemid=395)

<sup>26</sup> Jabatan Pengaliran dan Saliran Malaysia. (2010). *One State, One River Programme*. Retrieved August 07, 2010 from [http://www.water.gov.my/index.php?option=com\\_content&task=view&id=16&Itemid=395](http://www.water.gov.my/index.php?option=com_content&task=view&id=16&Itemid=395)



*The restoration of the source of Sungai Pencala by GAB Foundation & GEC in partnership with the National Landscape Department and DID Wilayah Persekutuan Kuala Lumpur*

#### 4.2) LOCAL COMMUNITIES AND PUBLIC AT LARGE

##### 4.2.1) DEFINITION OF COMMUNITY

“Community” may be defined as a social group of any size whose members reside in a specific locality, share government, and often have a common cultural and historical heritage. Sometimes a community may not even have a physical location, but is demarcated by a group of people with a common interest. Some people use the term “general public” in place of community when they are referring to anyone not associated with the government, private sector, or NGOs.

Communities can be big or small, formal or informal. They can be all of one race or ethnicity, or, as is common here in Malaysia, communities can be a wonderful blend of different races, creeds, and ethnicities to form one harmonious mix. A melting pot of people across the world makes up the global community.

Nowadays, the internet has further widened our definition of community. People from all over the world from many different physical communities can form virtual communities united only by common interests and the power to communicate freely.

On the other hand there is also the smaller local neighbourhood which you reside in. This community is a part of the larger public that has the power to bring change at a ‘local’ level.

For purposes herein, let us think of the communities at the local river basin level as including those people who impact or are affected by the health of the river and its tributaries or those interested in its welfare.

#### 4.2.2) COMMUNITY EMPOWERMENT

Local community involvement is essential for the long-term success of river basin management. One of the main reasons why government environmental conservation programmes sometimes do not fully achieve the intended result is because the local community is not sufficiently involved. This can happen for any number of reasons. People are busy and may not have the time to spare. They may simply not be aware of the need to help. Or the community may not think that there is anything wrong with their rivers or the way people use, or abuse, them. And at times the lack of interest may be because they believe that the health of a river should be maintained by the government.

Furthermore, some people may think that the government is not interested in their help and feedback or that ordinary people can't make a difference. This is where they are wrong. Individuals and local communities can be the biggest contributor to the success of river basin management but they must believe that they have the power to make a change. Communities feel this way when they are empowered by the results of their contribution to river management.

What is community empowerment? Community empowerment is the process of giving confidence, skills, rights and knowledge to communities to shape and influence their local areas and services. It is about people taking responsibility in tackling local problems, rather than expecting others to do so.

People feel empowered when they are able to contribute to solving a problem, like a river that needs a clean-up, and see the actual results of their own unique involvement in the decision-making process and on-the-ground results. We all know the pride and sense of accomplishment we feel when we satisfactorily complete a job regardless of how small the job is.

Imagine how powerful you would feel when you help to care for a whole river or river basin with the support

and input of friends, family, neighbours, and local government representatives, and see results. That is truly empowering and it is a feeling that grows and leads to a deep sense of responsibility and ownership.

How do we start the self-sustaining process of community empowerment? Through education and involvement of the community in river basin management, people become empowered. When the community has a better understanding of the issues and problems faced by rivers, the community can determine which of their own habits negatively impact river systems and how to deal with these bad habits. When the government invests trust in communities by sharing river management responsibilities, people will feel the strength of their own participation and develop feelings of "ownership toward the development and planning of project activities and solutions regarding rivers."<sup>27</sup>

#### 4.2.3) GENDER FACTOR

The gender factor is increasingly a concern in project documents, and has a cross-cutting element in promoting sustainable development and natural resource management. Increasing emphasis is given to making sure projects and other community interventions are gender sensitive and have a gender perspective.

Gender is significant because the values and strategies for biodiversity and its conservation are based on an individual's needs and roles. For instance, for a local community living by a river and whose lives depend on its resources, the concepts of the river and biodiversity are based on their cultural and livelihood contexts. A society's priorities in preserving a site or conserving biodiversity are based on gender views. Therefore, strategies employed by the community would vary because men and women have different needs based on gender. If a river management programme does not recognise these different needs, its effectiveness may be reduced or the rights of the community may be infringed upon.

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<sup>27</sup> *River Auditing: Let's Get To Know Our Rivers.* (2007). Global Environment Centre

One important aspect of environmental management is to enable and encourage participation as well as consensus among all stakeholders. This participatory process will only be meaningful if gender is integrated from the early stages, and followed through the implementation stages of a programme cycle as well as policy implementation.

Women can play an important role in river management as they are educators in the home and can impart positive values on the environment to their children. As housewives and mothers, they are keenly aware of the importance of clean water supply for good health.

Women's views should be sought but there are instances when this is a challenge. For instance, in a meeting with men who have higher authority, a woman's views are rarely heard. Therefore, measures must be taken to ensure that women are heard. This is relevant for NGO intervention at community level and therefore the identification of all key stakeholders is crucial.

Key stakeholders should be consulted in an initial gender assessment stage to identify and address any hindrances in terms of gender, if at all. It is important to identify the various needs and values relating to a particular environmental issue as well as any apparent or hidden responsibility to be borne by both genders.

#### 4.2.4) TAKING LOCALISED ACTION

As you read this Handbook, you might feel a little overwhelmed by all the problems faced by our river basins and the communities they nurture. It may seem that since the problems are so big, it is hard to decide where to start. There are many ways to get involved in caring for Malaysia's rivers. Reading this Handbook is a start. And one of the best ways is to get the local community involved in finding and implementing solutions for environmental issues affecting rivers in your neighbourhood.

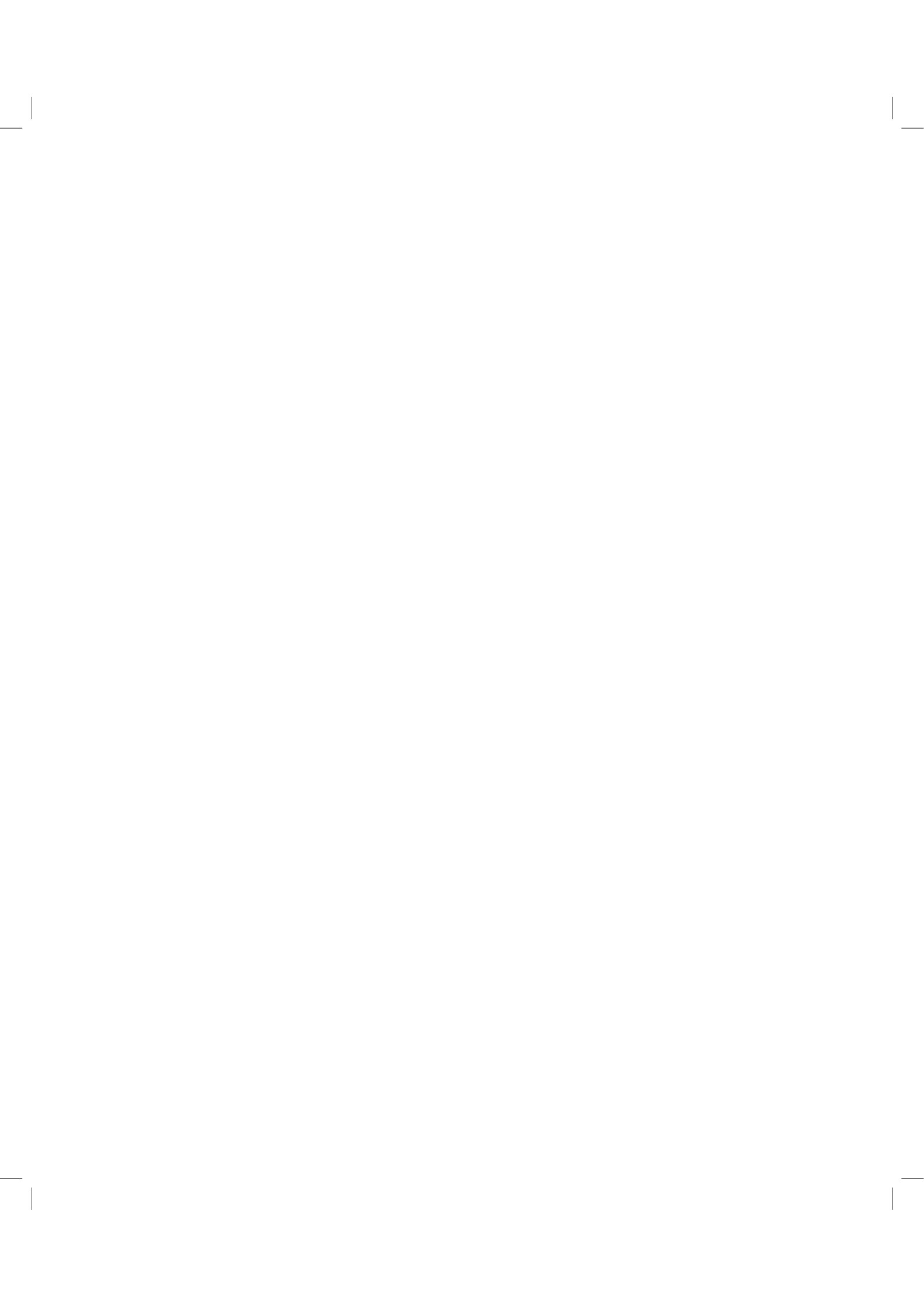
If you think about your involvement in incremental steps, rehabilitation of a river is not daunting. In the next chapter and beyond, we will go into more detail about the actual development of a local action plan. You can learn how to develop your community river action plan step-by-step, with the tools from our community river management kit to get you started.

Refer to Appendix 1 on how to participate in river monitoring activities.

Further information on this particular subject can be found in *First Steps: A Toolkit Towards Mainstreaming Gender in Biodiversity in Malaysia* by Malaysian Environmental NGOs (MENGO).<sup>28</sup>

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<sup>28</sup> Sunita Bisan, & Malar Selvaratnam. (2009). *First Steps: A Toolkit Towards Mainstreaming Gender in Biodiversity in Malaysia*. Selangor. Malaysian Environmental NGOs (MENGO) & Public Media Agency.





## **CHAPTER 5: River Management Guide**

## CHAPTER 5: River Management Guide

### 5.1) INTRODUCTION

Just like how a drop of water in a pool creates a ripple, the same happens when each one of us decides to make a change. We must start with ourselves. Doing things differently – that is towards protecting the environment, will help us make a difference in the environment collectively.

This chapter provides a vital step-by-step guide on how to establish and implement local actions to mitigate environmental issues, in this case - river issues. Furthermore, it will provide you with a number of useful tips to ensure the success of your activity/programme/project.

This publication offers different guidelines for government agencies and for communities.

### 5.2) GUIDE FOR GOVERNMENT AGENCIES TO ENGAGE COMMUNITY GROUPS

#### 5.2.1) ASSESSMENT

Conducting an assessment of a particular area is important as this will enable you to identify an issue that needs community engagement. This process will also assist you to identify stakeholders that should be involved.

#### 5.2.2) DESK OFFICER

Appoint a dedicated desk officer who is not only knowledgeable but has excellent experience in working with community groups.

#### 5.2.3) IDENTIFY A LOCALISED ISSUE

It is important to identify an issue in the targeted

project area because this will capture and sustain a community's interest. You are in fact suggesting a solution to their localised problem – a problem that has a direct impact on their daily lives. This will directly benefit them. If you suggest a solution to a problem that does not impact their daily lives at all, the project that you are about to embark on could already be considered a white elephant.

The community that you are dealing with may be aware of the problem but may not know how to solve it. By identifying the localised issue and providing possible solutions, the willingness to participate as a community group will be stronger.

To identify a localised issue, you must conduct a pre-assessment study, a survey and research via internet or by paying attention to issues raised by the mass media and by any other means of communication.

#### 5.2.4) PRE-CONSULTATION PROCESS

The consultation process has to be done with stakeholders and separately with a community leader. Identifying, enlightening and involving the relevant stakeholders at the early stage of identifying the issue will help you in the implementation phase. As for consultation with a community group, hold a forum or dialogue with them. It is important at this phase to get the community's consensus on the project before implementation.

#### 5.2.5) COMPILATION OF INFORMATION AND ANALYSIS

Based on the findings from the pre-consultation process with communities and other stakeholders, develop a short and long-term action plan.

#### 5.2.6) ESTABLISH TASK FORCE OR WORKING GROUP

Establish a formal working committee to plan and implement the actions. All stakeholders need to be involved (government agencies, private organisations, local politicians and leaders as well as communities).

#### 5.2.7) IDENTIFY POTENTIAL COMMUNITY GROUP(S)

Once you have gathered all the information, the next step is to engage the potential community group(s). Prior to engaging the community, it is essential to filter the groups and only target the community group(s) that is most willing to participate and work together on the project.

#### 5.2.8) CONSULTATION WITH POTENTIAL COMMUNITY GROUP(S)

Once you have identified the potential group, you need to consult them. Highlight the issues to them and enlighten them on the benefits (short and long term) if they participate. Get their consensus.

#### 5.2.9) LOCAL FACILITATOR

Once consensus has been achieved, appoint a local leader. He or she will be the one you will be communicating with and who will ensure all activities within the project are accomplished.

#### 5.2.10) EMPOWERMENT OF LOCAL LEADERS

Giving empowerment to the local leaders such as Rukun Tetangga (RTs), Resident Associations (RAs), community-based organisations, supporters, special interest groups and user groups will add positive value to the project that you are involved in. Through empowerment, the local leader will have more knowledge and deeper understanding of an issue and will be able to use skills that they have learnt to deal

with the issue. The empowerment of local leaders can be done via capacity-building (e.g. training, workshop and site visit).

#### 5.2.11) RECOGNITION AND ACKNOWLEDGEMENT

Recognise the efforts and increase the publicity for the community group that you are working with. Invite media to important events to publicise the project and to give recognition to the community and stakeholders for their efforts.

#### 5.2.12) INCENTIVE SCHEME

Apart from recognition and acknowledgement, you can also develop an incentive or award scheme for the community particularly for their support and efforts.

Acknowledge short-term successes as these will indirectly enhance a community's confidence and commitment.

#### 5.2.13) MONITORING

Do not abandon the project once it has ended. Continue to monitor as frequently as possible. Monitoring the project after it has ended will put your organisation in a positive light in the eyes of the community because it shows that your organisation genuinely cares for the project and the community.

#### 5.2.14) REPORTING

i) Maintain open lines of communication

a) Communicate with donors/supporters on a regular basis and communications can be initiated by both parties. In general, project teams must be able to seek clarification from donors. It is good practice to allocate time for reporting and liaison with donors. Donors may ask for a time-driven report such as detailed progress reports twice a year. Ideally the reporting requirement should



be proportional to the grant received thus preventing the team from spending too much time on paper work and allowing more time for project implementation. From time to time, the project team should also provide feedback to donors on the project's progress, which will create much goodwill in the process as well as closer working ties.

## ii) Project Outputs

- a) Another form of reporting is project outputs. This may be a book or guide featuring the project findings, a series of pamphlets, posters, manuals and audio-visual materials which can help create and increase community knowledge on environmental facts and issues.
- b) Stories, photos and findings of the project can also be featured on the website in video or text format. Some organisations have tapped social network platforms like Facebook for reporting on their project's progress and garnering support from the general public. This has been an effective method in building awareness and momentum for project activities, while helping to achieve its objectives.

## 5.3) GUIDE FOR COMMUNITY GROUPS TO ESTABLISH AND IMPLEMENT LOCALISED INITIATIVES

### 5.3.1) BE AWARE

To get to the root of any environmental problem, being aware of those problems is crucial especially problems that directly impact your neighbourhood. You can be aware of environmental problems through various means of communication (e.g. newspapers, magazines, websites, word of mouth) or from stakeholder agencies such as DOE, DID and National Solid Waste Management Department (NSWMD).

### 5.3.2) VERIFICATION FROM GOVERNMENT AGENCY

Consult with the relevant government agencies (e.g. local authority, DID, DOE) on any existing plans or activities to address the problem.

### 5.3.3) CONSENSUS AND SUPPORT

If there is no immediate government action plan, then you could take the issues up with the relevant community group.

Once you manage to get basic information through research on an issue that needs to be tackled, the next step is to raise the matter to your local community leader/members of RT/RA and get the green light. You could bring up the matter during a regularly scheduled meeting. The community group that you are in may already be addressing your specific concerns; if not, you may propose to the group to broaden its function to incorporate a specific environmental concern.

Ensure that they understand your intention as this will allow you to gain their support and ensure successful execution of an action plan that will directly impact the community and the environment in a positive manner.

### 5.3.4) RAISING AWARENESS

In order to inform other people within your community group and to get their participation, organise a consultation meeting with the support of your local community leader/RT/RA. Make sure they understand the river issue and get their feedback/views/concerns. During this stage, it is important to get their commitment to participate in the execution phase.

### 5.3.5) ESTABLISH A TEAM OR COMMITTEE

The option of setting up a team or committee will depend on the scale of the problem. If it is simple and

straight-forward, formation of an ad-hoc group will be sufficient to tackle the problem. If it is a bigger issue such as rehabilitation and pollution reduction, the establishment of a committee is important.

The committee should comprise 20 members at the most and must be balanced in terms of age, race and gender (if possible). Within the committee, elect a Chairperson, Vice Chairperson, Secretary, Treasurer and Working Group or Sub-working Group to carry out specific tasks.

### 5.3.6) IDENTIFYING ENVIRONMENTAL ISSUES AT THE LOCAL AREA

Prior to undertaking any action plan, it is important to identify the issue that is of the greatest concern and in this case, it should be river related. By identifying your river basin and river address and using the river mapping method, you will be able to collect information that can help in identifying a problem or issue in your local area. For details, refer to Appendix 1.

### 5.3.7) DEVELOP OBJECTIVES/GOALS

Once you have the basic information or list of environmental issues in your local area, it is best to identify the issue that concerns your community the most.

Concentrating on a particular issue that is of the gravest concern will allow your team to be effective as the effort of tackling the issue is focused and precise. Not much can be achieved if your team tries to solve all the environmental issues at the same time.

Below are the guidelines on how to develop objectives:

- Write down a list of environmental issues in your area.
- With the consensus of your team members, begin to prioritise which issues have to be tackled first.

- Develop an objective based on your prioritised issues. Remember to keep asking "Are you sure you "can" and "want" to do this?"

### 5.3.8) INVOLVING STAKEHOLDERS

After identifying your objectives, the next step is to involve stakeholders. Involving stakeholders will significantly increase the chances of success in solving your issue. Hence, stakeholder involvement is seen as an integral part of any community initiative. You can identify the right stakeholder based on the information that you gain from identifying your river basin and river address.

Stakeholders can be from various sectors. Examples include government agencies, corporations, local authorities, NGOs, service providers and communities.

Once you have identified them, the next step is to establish a network with the stakeholders. You must inform them of your plans and goals.

Establishing a network with stakeholders will help you acquire their commitment and support towards your community initiative.

By involving stakeholders, you are able to provide them with valuable opportunities to get closer to the public. Stakeholders can then understand the benefits of the activities/programmes/projects and gain insight on where and how they can contribute to the environment.

### 5.3.9) ACQUIRING INFORMATION/KNOWLEDGE AND CONTACTS VIA NETWORKING

For your team and you to acquire knowledge, you need to know where, who and how you can get knowledge from. You need to know the right contacts as this will directly enhance your community group efforts to preserve the environment.

Knowing the right people can open the right doors. When you establish your network of contacts you will inadvertently be linked to other people, thus enabling you to directly contribute to the building of a community that can check or even reverse environmental degradation.

No matter the challenge, whether it is your team requesting for funds to clean up your river or responding to a serious case of pollution, someone somewhere will have expert knowledge about your problem or would have experienced a similar situation. Enquire with others who work in the same field, for example, local NGOs, especially those who deal with the same issues, and get their help in finding solutions. A lot of time and energy can be saved by not reinventing the wheel.

To be an effective networker for the cause of environmental preservation, one must always maintain constant awareness of what is needed and how those needs can be met. As you begin to meet people and develop your network, you will become the link for people whose needs can easily be met through the resources of others you know. When you bring these people together, you not only assist others in meeting their needs, you also contribute to a common cause, which is improving the environment.

Following are a few suggestions of places where you can extend your network, both to meet the right people and to locate the right source of information needed in your efforts to pursue sustainability for your community.

- Universities and Schools

Schools and many universities in Malaysia have integrated environmental issues as a subject in their co-curriculum. Therefore, there could be an educator within your community who is aware of environmental issues in your area and has a collection of materials that he or she could share.

- NGOs and CBOs

NGOs and CBOs can provide information, knowledge and skill/experience about the environment as well as advice on other learning opportunities. Many are involved in research and education on environmental issues. Find out which ones are active in your community. They may very well be working on the same issues and eager to assist.

- Government Agencies and Local Authorities

Many local government agencies have information on environmental issues and can share knowledge on particular problems. They could also provide funds for a community to start an environmental project.

### 5.3.10) COMMUNITY ACTION PLAN

Your team is now implementing actions to curb environmental issues in your community area. However, before you start, action plans must first be designed to be as specific as possible and parallel to the objective. Carry out research on what actions can best achieve the objectives that have been set. An action plan should specify in detail how to address each issue and the steps needed to reach each of the related objectives. For more information, refer to Appendix 2.

The following is one example of how to design a community action plan.

Environmental Issue:

Objectives :

Action Plan :

Table : Designing an action plan form

| Action Steps | Person Responsible | Time Frame | Budget | Time Allocated | Resources | Indicators |
|--------------|--------------------|------------|--------|----------------|-----------|------------|
|              |                    |            |        |                |           |            |
|              |                    |            |        |                |           |            |
|              |                    |            |        |                |           |            |

Once your action plan has been designed, the next step is to present the action plan to the rest of your community members for their feedback. Following this, you can finalise the plan.

Once you have finalised the action plan, establish mechanisms to ensure all recommendations are executed via constant monitoring, reporting and evaluation.

### 5.3.11) MONITORING & EVALUATING

Ensure effective internal communications and monitoring.

Evaluate what is working, what is not and determine additional actions.

Environmental Issue:

Objectives :

Table : Evaluation form

| Action Steps | Action Taken | Actual Time Frame | Budget Used | Results | Next Steps |
|--------------|--------------|-------------------|-------------|---------|------------|
|              |              |                   |             |         |            |
|              |              |                   |             |         |            |
|              |              |                   |             |         |            |

### 5.3.12) SUSTAINABILITY OF ENVIRONMENTAL ACTIVITY/PROGRAMME/PROJECT

#### - Initial Social Impact Assessment

It is important to conduct a social impact assessment on a project at the onset, before implementation. In a community that has different social structures, it is important to assess the levels of acceptance of project intervention, to understand the local issues and get the support of local residents to participate actively. It is also imperative that the different groups are brought together to discuss and brainstorm the issues. This provides an opportunity for them to learn about the issues and problems faced by other groups in the community. Once all parties appreciate the situation, they are in a better position to manage and tackle the issues together.

#### - Project Ownership

When local communities understand and are consulted in the designing and implementing of a project, they will have a greater sense of ownership. This will increase the likelihood that the local community will continue with the activities that are relevant to their needs, even after funding for the project has ended.

One method to instill leadership within the community that will continue to drive the project is to set up community-driven bodies, for instance, volunteer groups or environmental stewards (e.g. Friends of Kelana Jaya Lake). Capacity-building and training workshops, annual or regular events, as well as social gatherings can be organised to enhance fellowship and bonding among volunteers. This will motivate volunteers while recognising their support and contribution, thus sustaining the momentum of the project.

#### - Community Leaders

It is important to empower not just one leader but to build a core group of community leaders, to prevent over-reliance on one person. Over-reliance on one person could lead to the collapse of the whole project should the leader be influenced against the project, move out of the community and there is no one to take over his or her role.

#### - Build Relations

Network with other CBOs, NGOs, RAs, government agencies and media to exchange knowledge and share experiences at local and national levels as well as with foreign counterparts. Collaborate on project activities and aim to leverage on media relations to get publicity; by doing this the project's momentum is bound to be sustained, thus keeping the cause alive.

#### - Importance of an Exit Strategy

An exit strategy must be in place before the implementation of any project. Ideally, an exit strategy should be an integral part of the project document to ensure the sustainability of the project's objectives and achievements. The exit strategy could be further training for community groups especially in areas related to their organisational, management and administrative skills. This includes the ability to identify potential funders and develop proposals to seek funds, write activity reports and handle accounting. Other potential activities can be advanced training on first aid skills, nature interpretation skills, water safety techniques, water monitoring skills, marketing and promotion of ecotourism ventures and managing the media.

## **Appendix: 1-4**

# RIVERS IN PENINSULAR MALAYSIA



Source: Department of Irrigation & Drainage Malaysia

## APPENDIX 1

### IDENTIFY RIVER BASIN AND RIVER ADDRESS

#### a) River Basin

A topographic map is required to identify which river basin you are living in. You can also use other maps such as aerial photograph maps, local plan maps or demographic distribution maps.

The first part involves the following steps:

- i) Locate the outlet of your basin. This will be the lowest elevation in your watershed and in most cases will be the mouth of your stream or river. Trace the stream from its mouth to its tributaries.
- ii) Using a pencil, mark along the stream and its tributaries every inch or so. At each mark, draw a line perpendicular to the stream or tributary, running out in both directions, and place an "X" at the highest elevation point on the map.
- iii) Then, locate the place where the stream originates or the beginning of each tributary, and extend a line out from each of these points in the direction opposite to the flow of water. Mark "X" at the highest elevation point.
- iv) Lastly, connect all the high points with a line, following ridges and crossing slopes at right angles to contour lines. The line formed will be the boundary of your watershed.

#### b) River Address

Once you have found the river basin you are living in, the next steps are:

- i) To mark your location, find the nearest stream or river, and note its name.
- ii) Follow the stream or river until it joins another stream or river.
- iii) Repeat the second step until the stream or river meets the sea.

*For example:*

*Your Home, Drain 1, Drain 2, River 1, River 2, Sea*

*SMK (P) Sri Aman, Parit Taman Aman, Pencala River, Klang River, Selat Melaka.*

### VISUAL OBSERVATION

The physical characteristics of a stream can give clues to the health of the stream. Healthy streams have lush riparian buffers, clear water and plenty of wildlife. Some of the physical characteristics of water quality are: water clarity, water colour, smell/odour, general land use, description of the stream origin & type, riparian vegetation (algae, wetlands), aquatic life (fish, prawns), and measurements of in-stream parameters such as width, depth, flow & substrate, drains, erosion and garbage. Refer to the River Report Card on page 74 on how to determine the health of a river.

### RIVER MAPPING

Through the investigations in River Mapping, you will collect information which may help identify a problem or issue in the local area. For example, after identifying that a local stream is heavily littered, you will need to ask a number of questions, such as: Where did the litter come from? What can be done about this? Who should we inform? River Mapping makes use of your natural senses, such as sight and smell to identify the physical attributes of the river and its surroundings. The first step is to map out your local area and the location of the river within this area. Once you have done this, you can add all the different types of land use you see in the area and activities that may affect the river.

Next, you should visit the river itself and record its appearance. What colour is the water? Is there any oily sheen on its surface? Think about what could be causing this and refer to the River Report Card for help. Other things you should note is the type of vegetation found near the river, how much there is, and whether there is any odour from the river.

Through River Mapping, you will learn how actions you take in your home, school or street can impact your wider environment.







# river report card

Our streams, rivers, lakes and wetlands are far more than just a part of the scenery - they are the lifeblood of the environment. They provide homes for wildlife and plants, water supplies for homes and industries, and places of recreation and enjoyment for all of us. In addition, rivers reflect the health of the surrounding land because they are the collection point for water coming from all around.

But how can you tell if a river is healthy? It is actually quite simple to estimate the overall condition of the river. You do not need high-tech equipments or chemicals, but you will need to use your senses, exercise common sense and have a genuine concern for the river.

On the next page, we have proposed categories in which you can judge your local river. In each category, you can rate your river and then combine your scores to come up with an overall rating for the area. You can then compare different rivers or sites along the same river. Keep detailed notes on each site, recording the location, date and information on anything particular that has varied from visit to visit. This is important so you can compare your scores if you visit the site on several occasions over time.

Write down scores for each category and total them up.

CATEGORY 1 + CATEGORY 2 + CATEGORY 3 + CATEGORY 4 + CATEGORY 5 + CATEGORY 6 + CATEGORY 7 + CATEGORY 8 + CATEGORY 9

TOTAL SCORE

## OVERALL RATING

What do you think of this site?

(Draw a mouth for the face according to the total score)



Mouth guide

|  |           |       |
|--|-----------|-------|
|  | excellent | 81-90 |
|  | good      | 61-80 |
|  | average   | 41-60 |
|  | poor      | 21-40 |
|  | very poor | 0-20  |

Scores

**Site Description**

Name of waterway / site : \_\_\_\_\_

Date : \_\_\_\_\_

Time : \_\_\_\_\_

Weather : \_\_\_\_\_

Has it rained in the past 24 hours?  
(if yes, was it heavy?)

Name : \_\_\_\_\_

Contact details : \_\_\_\_\_

School / organisation : \_\_\_\_\_

Crew size : \_\_\_\_\_

### category 1

**land use** List down the different land uses in the area.

- rating**
- 0-1 Lots of industry nearby, most land are cleared, bare soil, disturbed environment
  - 2-4 Some industry, some land cleared
  - 5-9 Some commercial, recreational and residential use
  - 10 No human use at all, in its natural state.

★ Create a list of places where the water is coming from.

### category 2

#### rubbish

Make note of the type of rubbish that can be found in the water or surrounding area (this includes human made waste and natural litter such as leaves and animal faeces) and how much is there.

- rating**
- 0-1 Lots of human made rubbish such as tyres, plastics and cans.
  - 2-4 oily films and excessive algae growth
  - 5-7 A lot of human made waste such as cans and plastic, or algae
  - 8-9 Some human made waste such as garden waste and plastics
  - 10 One or two pieces of human made waste and local vegetation such as leaves floating in the water
  - 10 No human use at all, preserved in its natural state

★ If rubbish seems to collect in one area, take photos of the area each time you monitor your site so you can compare rubbish build up.

### category 4

#### extra structures/modifications

Record any extra structure/modifications along the river at the site such as weirs, concrete banks, piers or any artificial modification of the water flow

- rating**
- 0-1 A number of artificial structures, large modifications of river's natural flow
  - 2-4 Some artificial structures or some flow modifications
  - 5-7 No concrete structures or minimal modifications of water flow
  - 8-10 No extra structures or artificial modifications

### category 7

#### vegetation

Look at the banks and the land extending from the river. Note if vegetation is natural or introduced and whether erosion occurs or not.

- rating**
- 0-1 Lots of introduced plants, much clearing, bare ground, pasture. Extensive erosion.
  - 2-4 Mixed plants, much clearing, large, eroded areas
  - 5-7 Mixed native and introduced plants. Some clearing. Small corridor of vegetation. Minor erosion.
  - 8-9 Mainly native plants, minor clearing. Natural vegetation extending up to 30m from water. No erosion.
  - 10 Mainly undisturbed native plants, extending up to 30m from water. No erosion.

### category 8

#### vertebrate animal life

(birds, reptiles, fish, amphibians & mammals)

Sit by your river and look for vertebrate animal activity. Record both the variety and number of animals. Look for fish and listen for frogs.

- rating**
- 0 No animal life visible at all
  - 1-2 One type of animal life found
  - 3-5 Two types of animals found
  - 6-8 Three types of animal life found
  - 9-10 More than three types of animal life found
- ★ Using bird books, learn the names of the birds found around the site and compile a list.

### category 9

#### water movement

(voices of the river)

How fast does the water flow?

- rating**
- 0-1 Stagnant, still and shallow water, shallow depth
  - 2-4 A little movement of mixing of water, shallow depth
  - 5-7 Movement at the speed of a slow walk, wind waves
  - 8-9 Good movement, the speed of a fast walk, wind waves
  - 10 The speed of running or faster, wind waves, bubbly sound

### category 6

#### water conditions

What colour is the river's water? Is the water clear or turbid?

- rating**
- 0-1 Milky brown or green colour with particles and scum. You can hardly see through it!
  - 2-4 Cloudiness and/or greenish colour with particles or film
  - 5-7 Some colour and particles
  - 8-9 A little colour
  - 10 Colourless and as clear as tap water

★ Record the flow of the water (slow, rapid, not flowing).

### category 7

#### vegetation

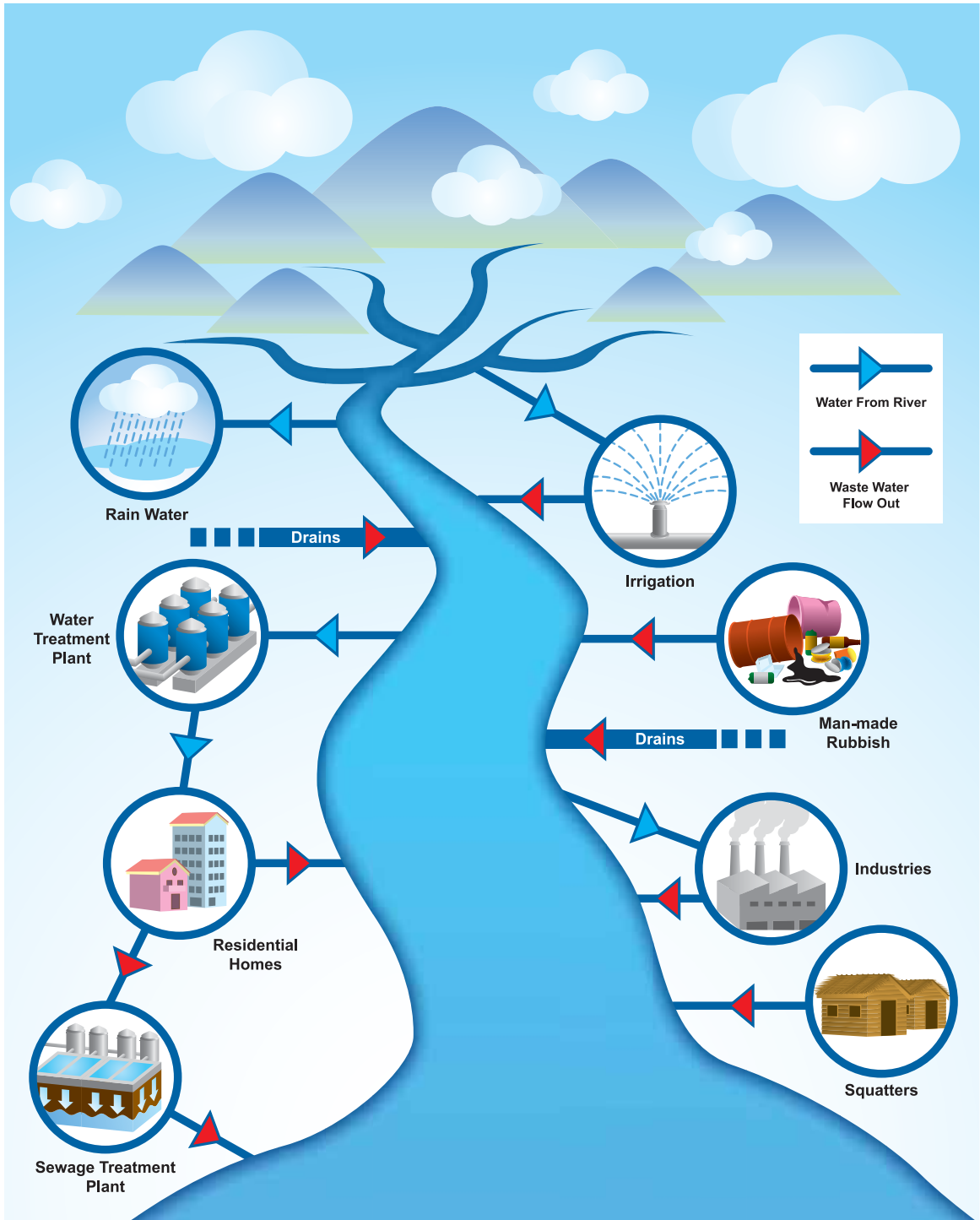
Look at the banks and the land extending from the river. Note if vegetation is natural or introduced and whether erosion occurs or not.

- rating**
- 0-1 Lots of introduced plants, much clearing, bare ground, pasture. Extensive erosion.
  - 2-4 Mixed plants, much clearing, large, eroded areas
  - 5-7 Mixed native and introduced plants. Some clearing. Small corridor of vegetation. Minor erosion.
  - 8-9 Mainly native plants, minor clearing. Natural vegetation extending up to 30m from water. No erosion.
  - 10 Mainly undisturbed native plants, extending up to 30m from water. No erosion.

#### map your area

Draw your local area map here and use a key to identify and record the different types of land use/human activities or other points of interest.

# RIVER MAPPING



## **POLLUTER MONITORING**

Acts of pollution are happening everywhere. As a citizen, you have the right to report any acts of pollution. It is not only your right, but your DUTY as well. We need people on the ground like you, to help authorities catch the culprits because it is impossible for authorities to monitor every single household or factory. So here are some steps that will help you monitor any illegal acts of pollution by people or industries, and report such acts. Please be careful and try to be discreet. Ensure your safety first. Take note of the registration number of the vehicle or which company it is from. Take note of the day, date, time and site where the act occurred. If you have a camera or mobile phone with you, take as many pictures as you can of the act, or the effects. Provide a description of the site, and describe the impacts of the pollution and any other information that would be useful to the authorities. Report everything you see to the DID, DOE and local government agency.

## **LOCAL AND GLOBAL ACTIVITIES**

One of the key factors that have led to the detrimental state of our rivers is the lack of community participation in river management. By raising the level of awareness and understanding the issues and problems faced by rivers, the government can stimulate the community to change their behaviour and habits which negatively impact river systems and help them to develop trust and ownership towards the development and planning of project activities and solutions regarding rivers. Through the community participation component, the government can run on-ground activities and workshops for the public and involve them in decision-making processes for their river basin.

List of river/water occasions during the year:

- 22 March - **World Water Day**
- 8 June - **World Ocean Day**
- 18 September - **World Water Monitoring Day**
- 19 September - **Clean Up The World**
- 26 September - **World River Day**

## APPENDIX 2

### a) Fundraising and Finding Sponsors

Prior to executing an action plan, one must find sponsors and/or raise funds as well as write funding proposals, two main factors which are related to each other. However, these two factors depend on your objective.

If your team already has a sufficient source of funding, it will not be necessary to request for funds or sponsorship. Nevertheless, following are some tips and tools for fundraising and developing proposals.

To successfully raise funds, define the need, communicate the cause, be creative and be persistent.

There are many ways to raise funds. Thus, there is no single formula as it all depends on your community and the situation. When fundraising, it is best to tap resources that are immediately available, for instance, through selling a product. If your organisation has many members, you could perhaps charge a small annual or monthly fee. At the same time, you may want to pursue external sources for funding, which will be easier to obtain if you can show how the funds will be used and the benefits/outcome.

### b) Writing Proposals

To apply for external sources for funding, you may have to write a proposal stating who you are, what you do, what you want and why you want it. Writing a grant proposal is actually a good exercise for an organisation to go through even if it is not planning on applying for grants. The process of writing a proposal forces you to evaluate your objectives, abilities, resources and understanding of the problems you are trying to solve. Following are a few basic principles to get you started with writing a proposal.

- In Malaysia, financial support for community-based projects is available from government agencies

(national, state and local government/authority), private sector, and elected representatives (MPs, ADUNs, and local councils).

- If you send a proposal asking for assistance in river rehabilitation to an organisation that works with women's education, chances are they will not even read it. Word your proposal in such a way as to make it cater to the target funding source's areas of interest.
- Though not a hard and fast rule, a customary structure for writing proposals is to start with a cover letter. This is followed by a proposal summary, an introduction, statement of the problem, goals and objectives, methods to solve the problem, budget for the proposed project and expected outcome.
- Your cover letter should briefly describe your organisation and your proposed project or programme that needs support. It should inform how important the grant would be to the community and who exactly would benefit from it. The cover letter should demonstrate the strong support of your organisation's committee or board of directors and any key figures in your community.
- Thinking through the various sections should enable you to provide virtually all the information that a private or government funding source will ask for. If possible, do a bit of "due diligence" beforehand and ask the target funding source what they are expecting from you. If they receive everything they need the first time you submit the proposal, they are more likely to react favourably to your request.
- Proposals requesting for private funds and government grants (intergovernmental or national) can often differ in form. Organisations often require a brief letter as an initial approach. A full proposal may follow in many situations. Government and intergovernmental funding sources often require completion of several forms along with a detailed proposal. Make sure that you write to the appropriate office or agency and request for guidelines before you start developing your proposal.

- The proposal itself may be as brief as one page (especially if the organisation limits you to one page) or it may be several pages long. It may be in a letter format or a more formal presentation. Any additional materials should be limited to those required by the funding source supplemented by pertinent information, such as the resumes of key people in your organisation.
- If required, you may have to submit a detailed expense projection for your proposed project, indicating exactly what you need the money for. Think through this process carefully, and if budget permits, contract the services of a qualified accountant to make sure that all your figures are correct. If a funding source suspects even for a moment that your budgeting is off, it will be less likely to give you the support you need.

#### c) Capacity-Building and Raising Awareness

It is important to empower the local community through capacity-building via seminars, workshops and training programmes. The community can be proactive and participate in activities organised by NGOs.

One of the most important factors in sustainability is education. When people know about a problem, they may work to solve it; when they understand the reason behind the problem, they can work to ensure that it never happens again. Understanding requires education that can come through an institute or university, a presentation at a community gathering or perhaps a brochure or booklet disseminated within a community.

It cannot be emphasised enough to check and re-check all your facts before communicating an environmental concern and attempting to educate your community about it. If your organisation is discredited once for not having all the right facts, it may be difficult to get the attention of your community at a later time.

The pool of expertise in educational institutions can be tapped in many ways to assist your community's efforts to support a sustainable environment. They can be a great source of information about the environment. They also comprise young minds that may need to be informed about the environmental concerns of a community.

You could work with your community's school if your organisation has a lot of expertise on environmental concerns, or knows where to obtain the resources. You could also hold a public seminar at a community centre to raise awareness.

#### d) Promotion and Awareness: Using the Media

Your organisation will need to communicate its goals and objectives to the public, both to attract more members and to encourage public awareness about important environmental issues. The media (newspapers, magazines, television and radio) can be powerful allies. For example, your organisation could run an environmental event and invite the media to attend. To achieve success in attracting the attention of the media, you need to fulfill two requirements: 1) find newsworthy ways of spreading your message; and 2) provide clear, professionally-presented information that the media can make use of.

## APPENDIX 3

### WATER QUALITY MONITORING

#### Why

Water quality data is used to determine the water quality status in clean, slightly polluted or polluted categories and to classify the rivers as either Class I, II, III, IV or V based on the Water Quality Index (WQI) and Interim National Water Quality Standards for Malaysia (INWQS).

#### How

The quality of the water is measured using the WQI which is computed based on 6 main parameters:

- Biochemical Oxygen Demand (BOD)
- Chemical Oxygen Demand (COD)
- Ammoniacal Nitrogen (NH<sub>3</sub>N)
- pH
- Dissolved Oxygen (DO)
- Total Suspended Solids (TSS)
- Temperature

Other parameters such as heavy metals and bacteria will be measured according to site requirements.

The water sample can be collected by volunteers or by engaging an accredited laboratory and it should be monitored at all stations once every two weeks. All parameters should be sampled on the same day.

#### Tools

Various types of tools and sampling equipment can be used in water sampling, depending on the budget, sampling location and purpose of the sampling. However, there are two most common types widely used by researchers, educators, students and the public when sampling the water: low range and high range. Low range is usually used for educational purposes and high range is more for scientific use. At some point, you may require to equip yourself with the right sampling tools such as rubber boots, buckets, gloves, strings and probably a boat if the sampling area is dangerously polluted water and not accessible by foot.

#### Sampling Sites

The water quality study can only be carried out if the sampling site has been identified and established. It is very important that the sampling site be at least accessible and not too far to conduct sampling. It must be safe especially for kids or students involved in the water monitoring programme. It is also essential for the river monitoring group to establish at least a minimum of three stations for the water sampling. Most importantly, the sampling site must cover upstream and downstream. However, there are no limitations in establishing the sampling site as long as the purpose and objective of the water sampling have been determined. Sampling must be carried out periodically at the same station every time.

#### Sampling Time

Usually for a community programme, sampling can be carried out on a quarterly basis (once in every three months). The water sampling can also be carried out once a month if budget is not an issue.

#### Methods

Collecting samples for water monitoring can be conducted for educational or scientific purposes. For scientific purpose, it will be carried out either in-situ or in a laboratory. The method can also be customised depending on the purpose of the water quality monitoring as well as sampling location. For example, river sampling should have at least three sampling locations and the sample should be collected periodically (once or twice a month) at the same sampling points each time. Please avoid collecting the sample during heavy rain or 24 hours after a downpour as it will significantly affect the reading of your water quality sample. Always make sure that at least two samplings of the same parameter are taken each time. Duplicate samples can be used as a control sample. By having duplicate samples, you can compare the reading and in the case of error, the duplicate data can be used as reference.

When calculating/collecting the data, please use an average data reading as the end result for your data reading. Please also take note that the more the sampling points you have, the more accurate the data will be.

## Results

Results of your water sample is based on the method you used during water sampling. The accuracy of your water quality data will most likely depend on the sampling equipment's sensitivity (low range or high range). If you used in-situ equipment, the result can be obtained on site. For laboratory analysis, you may need to wait several days before the result can be obtained. Most importantly, always compare your result

with other analytical procedures in order to get the most acceptable reading before a conclusion can be made on your water quality reading.

As mentioned earlier, the water quality status is determined by the WQI number. To calculate the WQI please refer to the formula below:

$$WQI = (0.22 * SIDO) + (0.19 * SIBOD) + (0.16 * SICOD) + (0.15 * SIAN) + (0.16 * SISS) + (0.12 * SipH)$$

where;

SIDO = SubIndex DO (% saturation)

SIBOD = SubIndex BOD

SICOD = SubIndex COD

SIAN = SubIndex NH3-N

SISS = SubIndex SS

SipH = SubIndex pH

$$0 \leq WQI \leq 100$$

For further details on water quality monitoring and its procedure, please visit the following websites :

[www.doe.gov.my](http://www.doe.gov.my);  
[www.riverranger.my](http://www.riverranger.my)



## APPENDIX 4

### HOW TO CONDUCT A BIODIVERSITY STUDY (SG WAY W.A.T.E.R. PROJECT)

Biological monitoring of river and stream life provides a remarkable insight into the functional quality of the environment. It can reveal important changes in the composition of biological communities caused by human activities. The insects and crustaceans that live in a waterway are indicators of the water quality because all organisms require specific conditions to live. We can use the presence of benthic macro-invertebrates to measure the water quality as they are large enough to see with the naked eye.

Stream-bottom macro-invertebrates are good indicators of the water quality because they differ in their sensitivity to stress in the waterway. Some benthic macro-invertebrates are very sensitive to pollutants in the water. Others are less sensitive to pollution and can be found in almost every stream. Benthic macro-invertebrates usually live in a same area in a stream



for most of their lives. Sampling the benthic macro-invertebrates in a stream is a good indication of what the water quality has been for the past few months. If the water quality is generally poor, or if a polluting event occurred within the past several months, it will be reflected in the macro-invertebrate population.

The bio-monitoring method involves collecting a sample of macro-invertebrates from the stream, identifying the organisms and rating the water quality. Water quality ratings of excellent, good, fair and poor are based on the tolerance levels of the organisms found and the diversity of organisms in the sample.

#### Why

In river water quality monitoring, each biological element and the quantity of this element need to be observed for their distribution, diversity and relative abundance of each species. Through this, it can reveal the status and health condition of their ecosystem. The presence of any of these micro-organisms, invertebrates, birds, fish, aquatic plants and certain types of riparian tree species can be used to determine the health of the river ecosystem.

#### How

Biodiversity study is interesting and easy to carry out. It does not require any specific skill, only some knowledge on how to sample, where to sample and what to look at, including additional reading on relevant topics. To carry out a biodiversity study on one river, it is important to decide your sampling location. The location must be fixed and a minimum of three locations is required. The more sampling locations, the better, as it will give you more accurate data. Please remember to collect your sample from the same site if there is a need for regular sampling or monitoring. Once the sampling location has been established, then plan your sampling schedule and always try to follow the schedule.

## Tools

Although biodiversity sampling does not require any specific skill for beginners to conduct the study, the use of the right tools is essential. This is to ensure minimal damage to the environment/ecosystem and injuries to the specimens. Some of the basic tools you need are listed below:

- a. Fishing net in various sizes (minimum 2 scoop net-different mesh sizes)
- b. One small plastic aquarium with partition for live specimens
- c. Magnifying glass for micro-organism/invertebrate observation
- d. Bio monitoring book for species identification (flora and fauna)
- e. Small sieves for screening sands and soil
- f. Small plastic pail
- g. One pair of rubber boots
- h. Map of the sampling area
- i. Data sheet

These are the basic and most common tools you need to have before conducting a biodiversity study. Tool requirement can vary depending on the study area and the sampling purposes. In cases where you need to preserve the sample, usage of hazardous/harmful chemicals may be involved. Therefore, expert advice from a relevant agency or department should be obtained before it can be carried out.



## Sampling Sites

There are several things that need to be considered when choosing a sampling location for your biodiversity study. Please take note that river biodiversity study and forest biodiversity study might be different. Therefore, choose your sampling site and identify it properly so it will fulfill your purpose.

For river biodiversity study, first you must determine your sampling location and make sure to cover both upstream/downstream and both river banks. You must establish at least three sampling stations or quadrat for flora or fauna observation. Sites must be accessible and safe enough for students, community members and researchers to carry out their monitoring activity.

## Sampling Periods

It is not necessary to conduct your biodiversity survey too frequently as it won't give you much variation in information. The most practical way is to carry out the sampling every six months for aquatic biodiversity survey and once a year for a flora survey.

## Methods

The biodiversity survey method is simple and usually based on observation, sample collection and preservation, and identification of species. The survey can be divided into two separate activities: aquatic and flora.

### a. Aquatic Survey

Here the monitoring is focused on the presence of invertebrate species in the river. With proper tools, try to sample any of the invertebrates shown in your 'invertebrates bio-monitoring' handbook. Focus on areas under the rock, on tree stumps, in the sand/soil, aquatic plant roots, among dead leaves and by river banks. Small invertebrates and tiny insects can be found hiding in these areas. Samples caught can be put in a small aquarium for species identification.

Give necessary ratings as per instructions in the invertebrate bio-monitoring book.

Fish can also be sampled but they are not a very good indicator of water quality. This is because fish have a higher level of tolerance compared to invertebrates. Therefore, for a short-term river biodiversity study, invertebrates are more significant than fish.

Aquatic plant biodiversity studies can be carried out through sampling and observation methods. Aquatic plants can be collected for identification of species and preserved for further analysis if necessary.

#### b. Flora Survey

This survey can be carried out through observation and sampling. You might need to walk along the river bank and observe the most obvious tree species with high distribution levels along the riverside. Tree leaves, flowers or tree barks can be used as samples for species identification. You can also prepare a herbarium for your plant biodiversity survey.

### Results

All your findings and results from the survey can be compiled and compared before and after the start of the project. It will also be useful if you can determine the baseline information on the biodiversity of the area under study for better monitoring and future management.

For further information on how to conduct biodiversity studies, please visit the following websites :

[www.waterproject.net.my](http://www.waterproject.net.my);  
[www.riverranger.my](http://www.riverranger.my)

# Glossary

## GLOSSARY

### A

**Algae:** Microscopic plants that photosynthesise.

**Alluvial:** Deposited by running water.

**Alluvium:** A general term for detrital deposits made by stream processes on riverbeds, floodplains, and alluvial fans; esp. a deposit of silt or silty clay laid down during times of flood. The term applies to stream deposits of recent time.

**Anoxia:** No oxygen present.

**Aquatic Habitat:** Habitat that occurs in water.

**Autotrophs:** Organisms that use energy from the sun or from the oxidation of inorganic substances to make organic molecules. They do not eat other organisms.

### B

**Backwater:** A small, generally shallow body of water attached to the main channel with little or no current of its own pushed back by a dam or current.

**Backwater Pool:** A pool that forms as a result of an obstruction like a large tree, weir, dam, or boulder.

**Bacteria:** Tiny organisms that break down dead matter.

**Bank Stability:** The properties of a stream bank that counteract erosion, for example, soil type and vegetative cover.

**Bank-full Width:** The width of a river or stream channel between the highest banks on either side of a stream.

**Bar:** An accumulation of alluvium (gravel or sand) caused by a decrease in water velocity.

**Base Flow:** The sustained portion of stream discharge that is drawn from natural storage sources, and not affected by human activity or regulation.

**Bed:** The bottom of a channel.

**Bed Material:** The sediment mixture that a stream bed is composed of.

**Bedrock:** Solid rock that underlies the soil and fragmented rock.

**Benthic:** On or in the substrate of a water body; bottom dwelling.

**Benthos:** Organisms that live on the bottom of aquatic environments.

**Biological:** Living plants or organisms.

**Boulder:** Substrate particle that is larger than cobble. Large (20+ inches) and Small (10-20 inches).

**Buffer Zone:** A barrier of permanent vegetation, either forest or other vegetation, between waterways and land uses such as agriculture or urban development, designed to intercept and filter out pollution before it reaches the surface water resource.

### C

**Channel:** An area that contains continuously or periodically flowing water that is confined by banks and a stream bed.

**Channelisation:** The process of changing (usually straightening) the natural path of a waterway.

**Chemical:** Parameters related to the chemistry of water.

**Chlorophyll-a:** A green pigment found in plants; used to measure the amount of algae.

**Clay:** Substrate particles that are smaller than silt and generally less than 0.003 mm in diameter.

**Community:** All the living things that dwell interdependently in a particular place and share the available energy and resources.

**Competition:** Rivalry for the same limited resource(s) by two or more individuals or groups of individuals.

**Confluence:** (1) The act of flowing together; the meeting or junction of two or more streams; also, the place where these streams meet. (2) The stream or body of water formed by the junction of two or more streams; a combined flood.

**Consumers:** Organisms that cannot make their own food and must obtain energy by eating other living things.

**Critical Velocity:** The velocity of water above which a plant or animal, in the stream or river bottom, will be washed downstream.

## D

**Decomposers:** Organisms (such as bacteria and fungi) that break down plant and animal remains into forms once again usable by producers (plants).

**Delta:** A deposit of sand, silt, and clay where swift waters enter a slower body of water and drop their sediment load. Deltas are usually triangular in shape, with the triangle pointing upstream, toward the source of swifter water.

**Detritus:** Dead plant, animal, and other organic matter.

**Discharge:** The volume of water passing a certain point along a stream or river in a given period of time.

**Dissolved Oxygen:** A measure of the amount of oxygen in the water. Concentration is the measure of the amount of oxygen in a volume of water. Saturation is a measurement of the amount of oxygen in the water compared to the amount of oxygen the water can actually hold at full saturation.

**Diversity:** The variety, number, and distribution of species within a community.

**Drift:** Algae, bacteria, detritus, and invertebrates that are carried downstream by the current.

## E

**Eddy Current:** A contrary turbulence that creates circular upstream currents behind rocks and other obstructions and along the edges of a stream or river channel. There is also a vertical movement of water in eddies, which mixes oxygen from above into the deeper layers, and provides thermal mixing.

**Emergent:** Rooted plants that can tolerate flooded soil but not extended periods of being completely submerged.

**Erosion:** The removal or wearing away of soil or rock by water, wind, or other agents.

## F

**Filter Feeders:** Organisms that feed by sieving fine food particles (plants, animals, or detritus) from the water.

**Flash Flood:** A sudden flood of great volume, usually caused by heavy rain. Also, a flood that crests in a short length of time and is often characterized by high velocity flows.

**Flow:** The amount of water passing a particular point in a stream or river, usually expressed in cubic feet per second.

**Floodplain:** Broad, flat lands along a river or stream that normally become inundated during floods, resulting in the deposition of sediments.

**Food Chain:** A way of showing how nutrients and energy pass from producers through the various

trophic levels in an ecosystem, such as from producers to herbivores, carnivores, and finally decomposers.

**Fry:** A recently hatched fish.

## G

**Groundwater Flow:** Water that moves through the subsurface soil and rocks.

**Groundwater Table:** The upper surface of the zone of saturation, except where the surface is formed by an impermeable body.

## H

**Habitat:** The physical environment in which a certain organism prefers to live.

**Heterotrophs:** An organism that is not capable of making its own food.

**Hydric:** Wet

**Hydrology:** The scientific study of the water of the earth, its occurrence, circulation and distribution, its chemical and physical properties, and its interaction with the environment, including its relationship to living things.

## I

**Infiltration:** The movement of water through the soil surface into the soil.

**Inflow:** Water that flows into a waterbody during a specific period of time.

**Instream Cover:** The layers of vegetation, like trees, shrubs, and overhanging vegetation, that are in the stream or immediately adjacent to the wetted channel.

**Instream Flow:** A flow or flow regime needed to maintain ecological health in a river or stream.

**Invertebrate:** An animal without a backbone.

## M

**Macro-invertebrates:** Organisms without a backbone, generally visible to the naked eye. "Bugs".

**Macrophyte:** Aquatic plants that are large enough to be seen with the naked eye.

**Meander:** The winding of a stream channel, usually in an erodible alluvial valley.

**Morphology:** The form, shape, or structure of a stream or organism.

## N

**Non-Point Source Pollution:** Pollution originating in the watershed, often entering the waterbody via surface runoff or groundwater. Pollution that does not originate from a clean or discrete source.

## O

**Oxygenated:** Holding oxygen in solution.

## P

**Pathogens:** Disease-causing organisms.

**Permeability:** The capability of soil and other geological formations to transmit water.

**pH:** A measure of the hydrogen ion activity in the water, or, in general terms, the acidity of the water.

**Photosynthesis:** Producing carbohydrates with the aid of sunlight.

**Physical:** Parameters that can be perceived using the senses.

**Phytoplankton:** Plankton that is composed of tiny plants and plant matter which consists largely of algae. These plants are major sources of production in aquatic systems.

**Plankton:** Plants and animals that are freely moving about the water column.

**Plant Zonation:** The zones of plants having different growth forms, which can be observed as a gradation moving from shallow to deep water (or vice versa): emergent zone, floating-leaved zone, submergent zone, and open water zone.

**Point Source Pollution:** Pollutants discharged from any identifiable point including pipes, ditches, channels, sewers, tunnels, and containers of various types.

**Producers (Primary):** Green plants and other organisms that are capable of changing inorganic

elements into organic tissues (food energy).

## R

**Rapid:** A reach of stream that is characterised by small falls and turbulent, high-velocity water.

**Reach:** A section of stream between two different points.

**Riffle:** A reach of stream that is characterised by shallow, fast moving water broken by the presence of rocks and boulders.

**Riparian Area:** An area of land and vegetation adjacent to a stream that has a direct effect on the stream. This includes woodlands, vegetation, and floodplains.

**Riparian Buffer:** The area of land and vegetation used to help filter pollution from entering a waterbody.

**Riparian Habitat:** The aquatic and terrestrial habitat adjacent to streams, lakes, estuaries, or other waterways.

**Riparian Vegetation:** Plants that grow rooted in the water table of a nearby wetland area such as a river, stream, reservoir, pond, spring, marsh, bog, meadow, etc.

**River Basin:** The entire geographical area drained by a river and its tributaries.

**Riverine Habitat:** The aquatic habitat within streams and rivers.

## S

**Scour:** The erosive action of running water in streams, which excavates and carries away material from the bed and banks.

**Sedimentation:** Deposition of sediments.

**Sediment Load:** The soil particles transported through a channel by stream flow.

**Silt / Clay:** Substrate particles that are <.062 millimeters.

**Slope:** The ratio of the change in elevation over distance.

**Spawning:** The depositing and fertilising of eggs by fish and other aquatic life.

**Stream Bank:** The side slopes of an active channel between which the stream flow is normally confined.

**Submergent:** Plants that grow and reproduce while completely submerged.

## T

**Tributary:** A stream that flows into another stream, river, or lake.

**Trophic Level:** Position in the food chain.

**Turbidity:** The amount of suspended particles in water, such as clay, silt, and algae that cause light to be scattered and absorbed, not transmitted in straight lines through the water.

## V

**Velocity:** The speed of water flowing in a watercourse, such as a river.

## W

**Wetland:** A wetland is an area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs, among others.





# Acronyms & Abbreviations

**W.A.T.E.R. PROJECT** Working Actively Through Education & Rehabilitation Project

|              |                                                                                   |
|--------------|-----------------------------------------------------------------------------------|
| <b>BCM</b>   | Billion Cubic Meters                                                              |
| <b>CBO</b>   | Community-based organisation                                                      |
| <b>DID</b>   | Department of Irrigation and Drainage                                             |
| <b>DOE</b>   | Department of Environment                                                         |
| <b>DOF</b>   | Department of Fisheries                                                           |
| <b>GEC</b>   | Global Environment Centre                                                         |
| <b>IRBM</b>  | Integrated River Basin Management                                                 |
| <b>IWRM</b>  | Integrated Water Resource Management                                              |
| <b>JPN</b>   | Jabatan Perpaduan Negara<br>(National Integration & Unity Department of Selangor) |
| <b>LA21</b>  | Local Agenda 21                                                                   |
| <b>LDP</b>   | Litre Per Day                                                                     |
| <b>LUAS</b>  | Lembaga Urus Air Selangor<br>(Selangor Water Management Authority)                |
| <b>MBPJ</b>  | Majlis Bandaraya Petaling Jaya<br>(Petaling Jaya City Council)                    |
| <b>MPK</b>   | Majlis Perbandaran Klang<br>(Klang Municipal Council)                             |
| <b>NRW</b>   | Non-Revenue Water                                                                 |
| <b>NSWMD</b> | National Solid Waste Management Department                                        |
| <b>RA</b>    | Resident Association                                                              |
| <b>RT</b>    | Rukun Tetangga                                                                    |
| <b>WQI</b>   | Water Quality Index                                                               |

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