



# SUNGAI KLANG

State of the River Report 2011

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LEMBAGA URUS  
AIR SELANGOR (LUAS)



*Sg. Klang derived its name from the word 'klong' from Mon-Khmer, one of the traditional language families of Southeast Asia. 'Klong' means warehouse, of which there were plenty in the Klang area. Klang was known as an important port, which grew in significance with the emergence of the tin mine trade in the 16th to 19th century.*

*The cover page shows the Klang Gates Quartz Ridge, together with the forests behind the Ridge that connect to the Ulu Gombak Forest Reserve. It was gazetted in February 2010 as 'state park' under the National Forestry Act Selangor Enactment, making it now an official part of Taman Negeri Selangor. Source: ©Treat Every Environment Special (TrEES)*

*Published by: Lembaga Urus Air Selangor (LUAS)  
With assistance from: Jurutera Perunding Zaaba Sdn. Bhd.*

*Second issue 2013  
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# ACRONYMS

ABASS	Konsortium ABASS Sdn. Bhd.
BOD	Biochemical oxygen demand
COD	Chemical oxygen demand
DOA	Jabatan Pertanian/ <i>Department of Agriculture</i>
DOF	Jabatan Perikanan/ <i>Department of Fisheries</i>
EPU	Economic Planning Unit
FRIM	Forest Research Institute Malaysia
GPT	Gross pollutant trap
IWK	Indah Water Konsortium Sdn. Bhd.
JAS	Jabatan Alam Sekitar/ <i>Department of Environment</i>
JKN	Jabatan Kesihatan Negara/ <i>Department of Health</i>
JKT	Jabatan Kerajaan Tempatan/ <i>Department of Local Government</i>
JKPTG	Jabatan Ketua Pengarah Tanah dan Galian/ <i>Department of Lands and Mines</i>
JKR	Jabatan Kerja Raya/ <i>Public Works Department</i>
JLM	Jabatan Laut Malaysia/ <i>Marine Department Malaysia</i>
JMG	Jabatan Mineral dan Geosains/ <i>Department of Mineral and Geoscience</i>
JPBD	Jabatan Perancangan Bandar dan Desa/ <i>Department of Town and Country Planning</i>
JPNS	Jabatan Perhutanan Negeri Selangor/ <i>Selangor Forestry Department</i>
JPP	Jabatan Perkhidmatan Pembentungan/Sewerage Services <i>Department</i>
JPS	Jabatan Pengairan dan Saliran/ <i>Department of Irrigation and Drainage</i>
JPSPN	Jabatan Pengurusan Sisa Pepejal Negara/ <i>Department of National Solid Waste Management</i>
JPV	Jabatan Perkhidmatan Veterinar/ <i>Department of Veterinary Services</i>
KeTTHA	Kementerian Tenaga, Teknologi Hijau dan Air/ <i>Ministry of Energy, Green Technology and Water</i>
LKIM	Lembaga Kemajuan Ikan Malaysia/ <i>Malaysian Fisheries Development Authority</i>

## ACRONYMS

LLM	Lembaga Lebuhraya Malaysia/ <i>Malaysian Highway Authority</i>
LUAS	Lembaga Urus Air Selangor/ <i>Selangor Water Management Authority</i>
MCM	Million cubic metre
MDKL	Majlis Daerah Kuala Langat/ <i>Kuala Langat District Council</i>
MDKS	Majlis Daerah Kuala Selangor/ <i>Kuala Selangor District Council</i>
MLD	Million litres per day
MNS	Malaysia Nature Society
NAHRIM	National Hydraulic Research Institute Malaysia
NH <sub>3</sub> -N	Ammoniacal nitrogen
PDTHL	Pejabat Daerah dan Tanah Hulu Langat/ <i>Hulu Langat Land and District Office</i>
PDTKL	Pejabat Daerah dan Tanah Kuala Langat/ <i>Kuala Langat Land and District Office</i>
PERHILITAN	Jabatan Perlindungan Hidupan Liar dan Taman Negara/ <i>Department of Wildlife and National Parks</i>
PKA	Port Klang Authority
PNSB	Puncak Niaga (M) Sdn. Bhd.
PPj	Perbadanan Putrajaya/ <i>Putrajaya Corporation</i>
ROL	River of Life
SPAN	Suruhanjaya Perkhidmatan Air Negara/ <i>National Water Services Commission</i>
SPLASH	Syarikat Pengeluar Air Sungai Selangor Sdn. Bhd.
SS	Suspended solids
STATS	Jabatan Perangkaan/ <i>Department of Statistics</i>
STP	Sewage treatment plant
SYABAS	Syarikat Bekalan Air Selangor Sdn. Bhd.
TSS	Total suspended solids
UPEN	Unit Perancangan Ekonomi Negeri/ <i>State Economic Planning Unit</i>
VFS	Vegetative filter strips
WTP	Water treatment plant



# INTRODUCTION

Our water resources are under pressure: effects of climate change with extremes in low and high rainfall; increase in population leading to increases in water demand; our continued lackadaisical attitude in our treatment of the resources; and general lack of adherence to regulations.

To ensure the sustainability of our rivers in spite of these pressures, Lembaga Urus Air Selangor (LUAS), together with other government agencies and private entities, publish State of the River Reports on regular intervals to report on the condition of river basins in Selangor. The Report provides a snapshot of the health of our rivers and gives planners and implementers feedback on how are we doing in using and managing our resources.

The State of the River Report for Sg. Klang provides an overall view of the river basin from the years 2009 to 2011. It is a handbook as well as a report. It explains the status and conditions of the various resources within the river network. It also covers the various issues on our uses and demands of the rivers, as well as our impact back to the same rivers that serve us.

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## CONTRIBUTORS

State government and private agencies have generously contributed their time, effort, and thoughts towards making this booklet as resourceful as possible. In this way, LUAS is the enabler for the

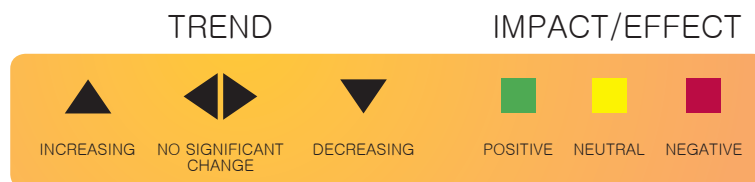
dissemination of information provided by the agencies for the use of all people interested in preserving and caring for our precious water resources. We extend our gratitude to these contributors, whose names are listed in Appendix E.

## HOW TO USE THE INDICATORS

Indicators provide a measure of how healthy our rivers are. A river's health can be measured in terms of various criteria such as biological, chemical or physical.

In this report, there are seven key indicators that show the overall status of the river. The status of these indicators is shown by a colour coded icon that indicates an upward or downward trend.

The key for the indicators is shown below. The direction of the triangles show whether the trend is increasing, decreasing, or no change. The colour of the triangle indicates whether the trend is positive, negative, or neutral (neither good nor bad).



*Key for the Indicators*

# ABOUT THE RIVER BASIN

## LOCATION

The Sg. Klang basin is located in central Selangor on the west coast of Peninsular Malaysia. The basin is approximately 120 km long and covers an area of about 1,288 km<sup>2</sup>, which encompasses most of the Federal Territory of Kuala Lumpur and parts of the state of Selangor. There are seven river basins in Selangor, among which the Sg. Klang basin is the fourth largest.



### ***Tributaries***

The main tributaries of the Sg. Klang basin are Sg. Batu, Sg. Gombak, Sg. Ampang, Sg. Kerayong, Sg. Kuyoh, Sg. Penchala and Sg. Damansara.

### ***Major Towns and Administrative Bodies***

The Federal Territory of Kuala Lumpur straddles the middle section of the basin while the upper and lower sections fall within the state of Selangor. The upper section comes under the jurisdiction of the three local authorities of Ampang Jaya, Ulu Langat and Gombak. The lower section is under the jurisdiction of the four authorities of Petaling Jaya, Subang Jaya, Shah Alam and Klang.

The major towns and cities are Selayang, Ampang Jaya, Kuala Lumpur, Petaling Jaya, Subang Jaya, Shah Alam, and Klang.

District	Administrative Bodies
Kuala Lumpur	Dewan Bandaraya Kuala Lumpur
Petaling	Majlis Bandaraya Petaling Jaya, Majlis Bandaraya Shah Alam
Klang	Majlis Perbandaran Klang Majlis Perbandaran Subang Jaya
Gombak	Majlis Perbandaran Ampang Jaya Majlis Perbandaran Selayang

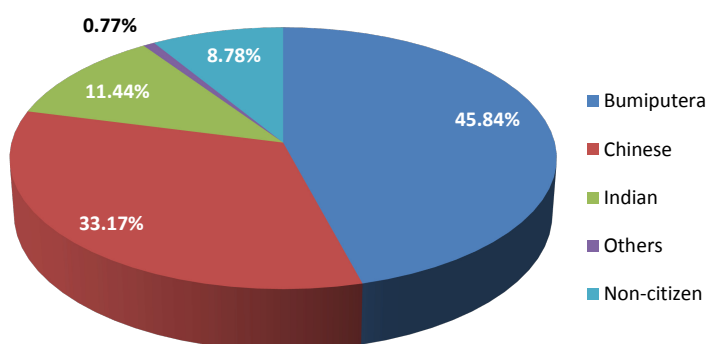
Source: LUAS 2012

### ***Population***

The population of the Sg. Klang Basin is approximately 4,537,083 according to Jabatan Perangkaan Selangor. The basin is populated by Bumiputera at 46%, followed by Chinese at 33%. Indians occupy 11%, other races 9% and non-citizens less than 1%.



**JPM** is an agency that provides statistical services and conducts census of the population



*Breakdown of the Sg. Klang Basin population*  
*Source: Jabatan Perangkaan Selangor 2012*



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## ABOUT THE RIVER BASIN

*Pristine waters in the upper part of the Sg. Klang  
basin at Taman Melawati, Ulu Klang*

## MAIN USES OF THE RIVER



Once a free-flowing river, Sg. Klang has been extensively channelised over the years for purposes of flood mitigation. Weaving its way through the Klang Valley which is home to about 20% of the country's total population, the river has seen massive urban development around it, resulting in extensive river pollution and frequent, debilitating flooding.

In an effort to revitalize the river and the land around it, a massive federal government river rehabilitation project called the River of Life (ROL) is currently underway. Once completed in 2016, the newly rehabilitated Sg. Klang will serve as a showcase for the revitalization of central Kuala Lumpur business districts and a source of riverside attractions.

Another project under the Selangor Economic Stimulus Plan is the Sg. Klang Conservation and Development Project or Projek Pemulihan dan Pembangunan Sungai Klang (PPPSK), which focuses on conserving the natural features along the river corridor, exploring the use of the river for navigation of small boats, and ensuring the state's water supply. Under these federal and state government initiatives, the future use of the river is expected to promote tourism, recreation and navigation activities as well as assuring water supply continuity.



*Sg. Ampang across from Dato Keramat, Kuala Lumpur*

## DISTINCTIVE FEATURES OF THE BASIN

What distinguishes the Sg. Klang basin from other basins are some natural and manmade structures that add uniqueness to the basin. The **Selangor State Park** is the third largest park in Peninsular Malaysia and

## ABOUT THE RIVER BASIN

has strategic interest to residents of Selangor, Kuala Lumpur and Putrajaya as it protects 98% of the water resources for these areas. As of 2010, 93,000 hectares were gazetted as state park, including the magnificent Klang Gates Quartz Ridge.



*Quartz Ridge Source: DeXXy.Net*

**The Quartz Ridge**, located at the upper reaches of the basin, is made up entirely of white milky quartz and is one of the longest quartz outcrops in the world.

Nearby is the **Klang Gates Dam**, which opened in 1958, making it the first reservoir in Malaysia. It is located in an area that is a favourite hiking spot for many residents seeking refuge from the city, although the dam itself is inaccessible to the public. On 2 December 2010, LUAS gazetted this catchment as a zone of protection.



*Klang Gates Dam  
Source: puncakniaga.com.my*



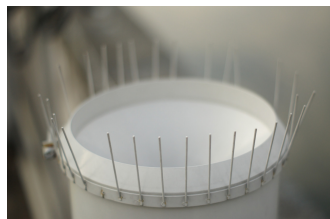
The iconic 'Stormwater Management and Road Tunnel' or **SMART Tunnel**, solved the dual problem of flash floods in the Jalan Melayu/ Masjid India area of the Kuala Lumpur city centre and traffic jams along Jalan Sungai Besi and Loke Yew flyover at Pudu. A unique feature of the 9.7 km tunnel is its dual purpose function as a stormwater and motorway tunnel, making it the longest multi-purpose tunnel in the world. SMART Tunnel is operated by Jabatan Pengairan dan Saliran (JPS).



*A two-level motorway and a third level for stormwater conveyance  
Source: JPS*



The **Integrated Flood Forecasting and River Monitoring (iFFRM)** System for the Klang Valley processes hydrological, hydrodynamic and meteorological data from stations within the basin to forecast and monitor river floods in real time.



*Service pole with telemetric and hydrological equipment; inside a datalogger; rain gauge*



*Sg. Klang as it flows from the Klang Gates*

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## SIGNIFICANT RIVER WORKS

Significant works within the Sg. Klang basin involved river and drainage system improvements, erosion control works, and works under the ROL. They are carried out by JPS.

Significant River Works	
2010	River improvement of the Rajah River in Rawang
2010	Improvement of the drainage system for Bukit Kapar Phase II in Klang
2011	Erosion control works of tributaries along the Damansara River in Petaling
2011	Upgrading of drainage system to overcome flood problems in the Selayang area of Mukim Batu, Gombak District
2011	Flood prevention works at Sungai Sekamat, Mukim Cheras, Hulu Langat
2011	Riverbank upgrading of Sg. Balak, Kajang District, Hulu Langat
2011	Upgrading of drainage system at Bukit Kapar, Phase II, Klang District
2011	The ROL project has three components, which are river cleaning, river masterplanning and beautification, and river development. Package 4 of the ROL project includes specific works that commenced in 2011 such as the installation of gross pollutant traps and river bank improvement works. The installation of automated trash rakes is expected to start in 2012.

Source: JPS Selangor

In addition to these works, there are six more projects involving river upgrading and flood protection that have started in 2011 and are scheduled to be completed in 2012.



*The Gombak Diversion helps prevent river breaching of Sg. Gombak by diverting excess stormwater to Sg. Batu*

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## LAND USE

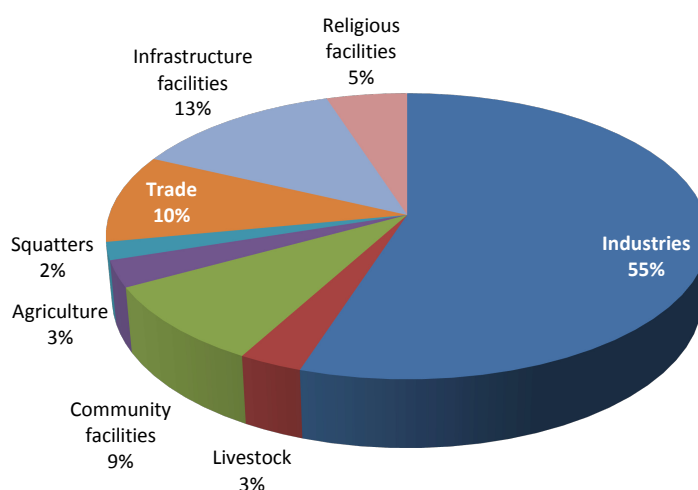
Land use is a good indicator of the water quality in the basin. In fact, land use is often used to correlate human activities to raw water resources and their impact on water quality. In 2011, Jabatan Perancangan Bandar dan Desa (JPBD) Selangor and JPS Selangor

conducted a thorough inventory of assets and activities on the river reserve along the length of Sg. Klang starting from Klang Gates and extending down to the mouth of the river at the coast. All structures, buildings and human activities situated 50 m from the river bank were recorded. One of the results of this exercise is a detailed description of land use along the river reserve.

Land use varies along different sections of the Sg. Klang. In the upper catchment area in the Gombak district, heavy and light industries dominate the basin at 55%, followed by infrastructural facilities (15%), small businesses and community facilities.

Among the heavy and light industries, automotives workshops, furniture making and iron welding are the most in number while religious facilities, agricultural and livestock farms and squatters are the least.

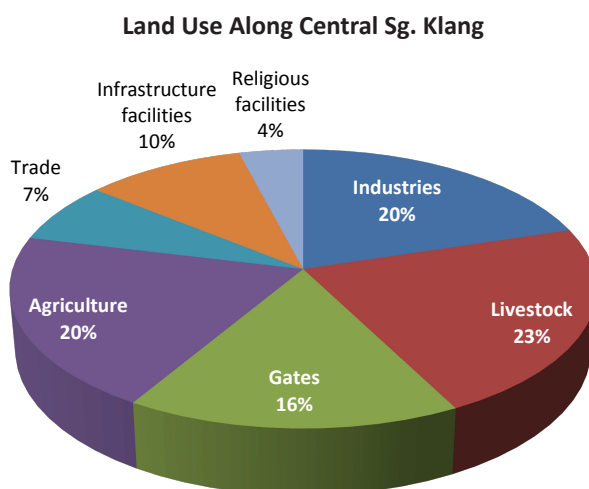
**Land Use Along Upper Sg. Klang**



Source: JPBD Selangor 2011

The land use changes as the river flows along the reserves at the central section of the basin. Here, the land use changes to predominantly livestock (23%), agriculture (20%) and industries (20%), followed by infrastructure facilities (10%). At the bottom of the list are businesses, religious facilities, and squatters.

Among the livestock farms, goats, catfish, ducks, and chicken are the most common, followed by cows and fishing ponds.

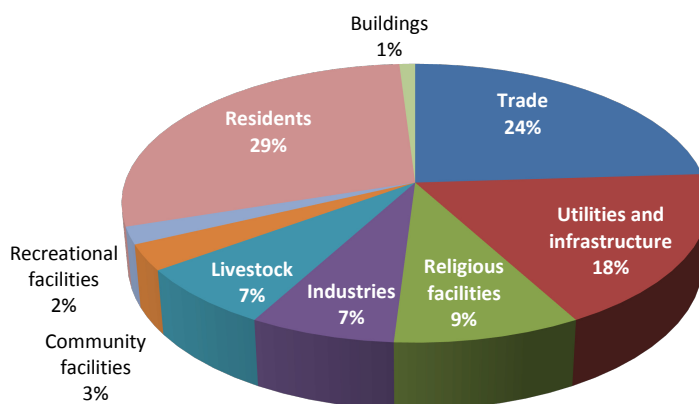


*Source: JPBD Selangor 2011*

At the mouth of the Sg. Klang, the land use concentrates on residential and business use, followed by, in order of concentration, utilities and infrastructure industry, squatters, agriculture, livestock, religious facilities, gates, jetties, bridges, and log booms.

Business activities along the reserve are broken down into food stalls and restaurant (20%), automotive workshops (3%), stores (76%), and hotel (1%).

**Land Use Along Lower Sg. Klang**



*Source: JPBD Selangor 2011*

The ROL project is expected to have an impact on land use. As of 2011 DBKL has ordered a freeze on all transactions of government-owned land near Sg. Klang in the city centre pending completion of the project and subsequent land value reassessment.

# SUNGAI KLANG RIVER BASIN

## LEGEND

STATE BORDER

RIVER



DUMPING SITE



STONE QUARRY



FACTORY



LAND CLEARING



RESIDENTIAL AREA



RECREATION CENTER

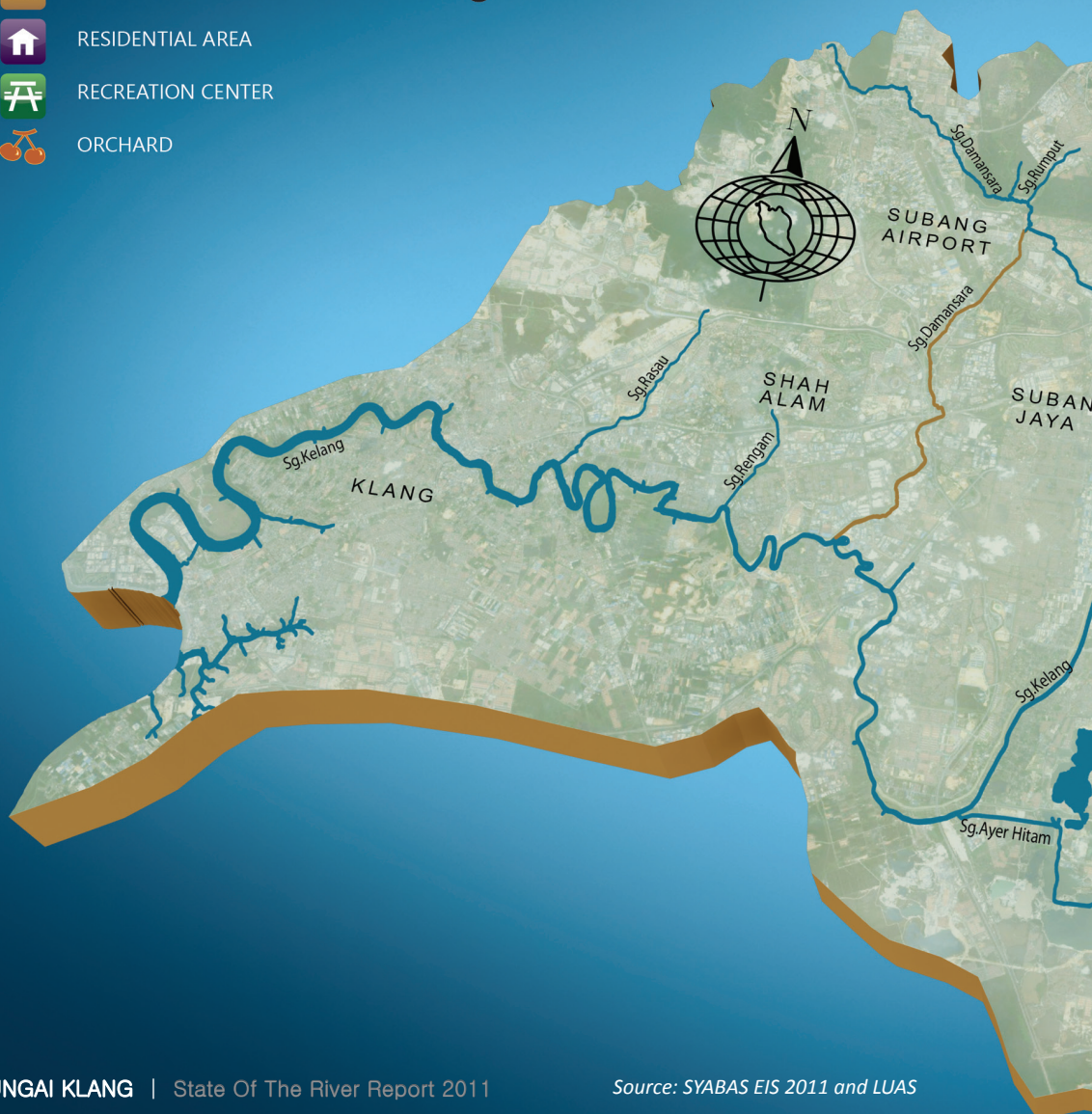


ORCHARD



## WATER INTAKE POINTS

- 1 BUKIT NANAS WTP
- 2 SG. BATU WTP
- 3 SG. GOMBAK WTP
- 4 AMPANG INTAKE WTP
- 5 SG. RUMPUT WTP
- 6 WANGSA MAJU WTP







# RIVER BASIN MANAGEMENT

Activities and assets within the river basin are managed by a number of government bodies.

## REGULATION OF WATER SUPPLY AND SEWERAGE SERVICES



**SPAN** is a government commission that regulates water supply and sewerage services

Since 2007, all water-related services, including those in Selangor, have been regulated by a federal agency called the National Water Services Commission or Suruhanjaya Perkhidmatan Air Negara (SPAN). The Commission authorises and issues licenses of all water supply and sewerage services in Selangor. One of the major changes under the new water law makes communal septic tanks (CSTs) and individual septic tanks (ISTs) the responsibility of individual owners and tenants. Another change in the law empowers SPAN to regulate sewage permit holders and Indah Water Konsortium.

## PLANNING OF WATER RESOURCES

While distribution falls under federal regulation, the state government, through the Selangor Economic Planning Unit (UPEN), retains the power to declare water supply resources, water catchment areas, and river basins. UPEN also ensures that water agreements are adhered to by the various water concessionaires and other parties.

The Selangor state government also articulated the need for the introduction of a river protocol to control and manage the rivers in the

state. This may be needed as JPBD Selangor, which had conducted an extensive survey of the river corridor in Sg. Klang in 2011, highlighted that there was a need for better management of the river corridor and adherence to river-related guidelines.

## MONITORING OF WATER RESOURCES



**LUAS** is a state agency for regulating and managing all water resources in Selangor

A number of agencies monitor water resources and water quality throughout the river basin. One of them is Lembaga Urus Air Selangor (LUAS), a water resources management body that monitors and enforces control over human activities for the management of water resources, river basins, water bodies, ground water and coastal waters in the state of Selangor. Water quality of rivers is also monitored by other agencies and organisations such as water concessionaires, water distributors, Jabatan Alam Sekitar Selangor and Jabatan Kesihatan Negeri Selangor. Through LUAS, information is shared so that any issues or problems arising can be handled effectively and expeditiously.

Currently, LUAS addresses violations mainly on the basis of incoming complaints or reports. To enlarge its scope of responsibilities to become more proactive, an “Emission or Discharge of Pollutants (State of Selangor) 2012” [*Peraturan-Peraturan Kemasukan Atau Pelepasan Bahan Pencemar (Negeri Selangor) 2012*] is currently being drafted for gazetting in 2012. The proposed list of activities to be expanded is shown below. With an expanded scope, LUAS can better regulate errant end-users of water resources.

Activity	LUAS' Expanded Scope
Freshwater aquaculture in ponds or cages	Operating breeding area of fifty (50) hectares or above
Marine shrimp aquaculture in ponds	Operating breeding area of ten (10) hectares or above
Development and earthworks	For areas less than fifty (50) hectares
Livestock other than pigs	Chicken, ducks, geese, turkeys, guinea fowl, guinea, pigeon, ostrich, emu, cows, goats and other livestock in number of twenty thousand (20,000) or more
Swine livestock	All farms regardless of the number

Pets	Activities involving twenty (20) cats or dogs or more
Mining-related activities	Any type of sand mining, soil and other irrespective of the quantity Mining or quarry in areas less than two hundred (200) hectares

Source: LUAS 2011

### ***Subsidiary Legislation***

The state of Selangor has passed several laws between 2009 and 2011 relating to the management of the river basin.

In 2009, the *Port Klang Coastal Strategy Implementation Plan* was gazetted for implementation. The Plan, which was prepared by LUAS and approved by the state of Selangor in 2007, delineates actions to address water pollution, destruction of habitat, solid waste, health, over-exploitation of natural resources, and erosion and sedimentation.

In 2010, the *Notification of Charges For Diversion of Water From Any Water Source 2010*, was ratified, allowing LUAS to prescribe a rate for the diversion of water for electricity generation.

In the same year, a regulation called the *Zone of Protection (Declared Area and Restriction) Notification 2010* was gazetted to protect part of the wetland area, river reserve and environmentally sensitive coastal area at Mukim Kapar in the district of Klang. The regulation places restrictions on the building of structures and carrying out of works, application or storage of chemicals, alteration of existing land contours, clearing or harvesting of vegetation and discharges of any effluent or waste.

Another 2010 regulation, *Zone of Protection (Declared Area and Restriction) (No. 2) Notification 2010* protects and reserves water resources and their environment in the catchment area for dams within the state of Selangor. It protects Klang Gates Dam, Batu Dam, Langat Dam, Sungai Selangor Dam, Semenyih Dam, Sungai Tinggi Dam and Tasik Subang Dam.



## RIVER BASIN MANAGEMENT

*SMART retention pond at Kampung Berembang, Kuala Lumpur*

# WATER RESOURCES AND SUPPLY

## SURFACE WATER

Sixty percent of water supplied to the Klang Valley comes from the Sg. Selangor basin, while the rest of the water supply comes from the Sg. Langat and Sg. Klang basin. There are six water treatment plants (WTPs) with an equal number of intakes points within the Sg. Klang basin. All WTPs are operated by Puncak Niaga Sdn. Bhd.

	WTP	Raw Water Source
1	Bukit Nanas	Klang Gates Dam
2	Sg. Batu	Sg. Batu
3	Gombak	Sg. Gombak
4	Ampang Intake	Sg. Ampang
5	Sg. Rumpit	Sg. Rumpit
6	Wangsa Maju	Klang Gates Dam and Sg. Gombak

*Water Intake points within the Sg. Klang basin*

*Source: SYABAS EIS 2011*

The source waters originate from the upstream area of the basin with minimum disturbance and development within the riparian area. The abstraction of raw water for these WTPs is entirely from surface water sources.

Bukit Nanas WTP and Sungai Batu WTPs draw directly from Klang Gates Dam and Sungai Batu Dam. WTPs for Sungai Gombak, Wangsa Maju,

Ampang Intake and Sungai Rumpit obtain raw water supply from rivers. Wangsa Maju WTP has the option to abstract water from Klang Gates Dam as an alternative supply.

## Water Reservoirs

**Klang Gates Dam**  
Catchment: 77 km<sup>2</sup>  
Dam area: 2.7 km<sup>2</sup>  
Capacity: 32,013 ML  
Yield: 205 MLD  
Type: Reinforced concrete

Klang Gates Dam, Tasik Subang Dam and Batu Dam are major water reservoirs within the Sg. Klang Basin. Klang Gates Dam is a reinforced concrete dam with a capacity of 32,013 million litres (ML), while Tasik Subang Dam is an earth embankment with capacity of 33,600 ML. Both are operated by Puncak Niaga.

Batu Dam, with capacity of 30,199 ML, is operated by JPS Federal Territories. This dam not only serves as water supply but is also used for flood mitigation.

The Klang Gates Dam provides a yield of 205 million litres per day (MLD), the Batu Dam 114 MLD, and the Tasik Subang Dam 21 MLD. These dams, while serving as water supply, are not the major source of potable water for the river basin. In fact, much of the potable water for the Klang Valley is supplied from the dams in the Sg. Selangor Basin.

**Tasik Subang Dam**  
Catchment: 77 km<sup>2</sup>  
Dam area: 2.7 km<sup>2</sup>  
Capacity: 33,600 ML  
Type: Earth embankment

## Production Capacity

The total design capacity of all WTPs within the catchment is 355.37 MLD.

No	Water Treatment Plant	Operator	Design Capacity (MLD)
1	Bukit Nanas	PNSB	145.00
2	Sg. Batu	PNSB	113.70
3	Wangsa Maju	PNSB	45.00
4	Gombak	PNSB	31.37
5	Ampang Intake	PNSB	18.00
6	Sg. Rumpit	PNSB	2.30
Total			355.37

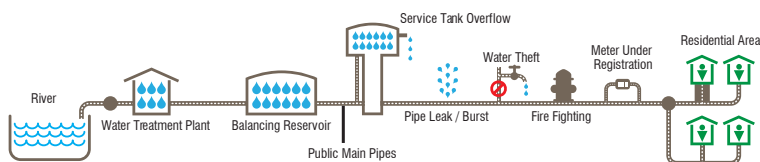
Source: Puncak Niaga website

**Batu Dam**  
Catchment: 50 km<sup>2</sup>  
Dam area: 2.5 km<sup>2</sup>  
Capacity: 30,199 ML  
Yield: 114 MLD  
Type: Earthfill

## Issues

Non-revenue water, or NRW, is a major source of losses for water distribution companies. Elements contributing to NRW are service tank overflow, leaking or burst pipes, water theft, and tampered meters.

### Elements Contributing to NRW



Sources of NRW

Source: Malaysia Water Guide 2011

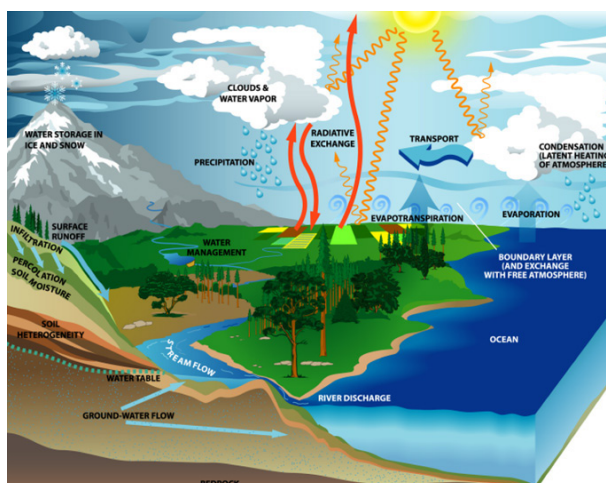
#### NRW

2008	34%
2009-2011	32%

The NRW for Selangor over the years 2009 to 2011 has been consistently hovering around the 32% mark, down from almost 34% in 2008. Efforts have been made to address this issue—SPAN has been monitoring NRW since January 2008—and NRW is a key performance indicator, or KPI item for all water distribution operators.

## GROUND WATER

*Ground water* is water that fills spaces between sand grains, in rock crevices and in solution openings. LUAS refers to ground water as subsurface water that occurs beneath the water table in soils and geologic formations. It includes wells, boreholes or any similar work sunk into underground strata, any excavation into underground strata, and any designated ground water.



*Hydrological process including the ground water system*

*Source: Ministry of Natural Resources and Environment website 2012*

Within Malaysia, ground water accounts for more than 90% of freshwater resources. Renewable water resources are 630 billion m<sup>3</sup>, which is the summation of surface runoff and ground water recharge. This translates into an annual average water availability of approximately 28,400 m<sup>3</sup> per capita. Currently, surface water represents 97% of the total water use, while ground water is about 3%. Approximately 60–65% of ground water is used for domestic or municipal purposes, 5% for irrigation and 30–35% for industry.

Water Resources	Volume
Annual rainfall	990 billion m <sup>3</sup>
Surface runoff	566 billion m <sup>3</sup>
Evapotranspiration	360 billion m <sup>3</sup>
Ground water recharge	360 billion m <sup>3</sup>
Surface artificial recharge	25 billion m <sup>3</sup>
Ground water recharge	5,000 billion m <sup>3</sup>

*Water resources in Malaysia*

*Source: Azuhan 1999*

In Selangor, the ground water recharge is 150 mm yearly, which is equivalent to 1,220 million cubic metres (MCM) or 3,350 MLD. According

to some sources, as ground water is part of the hydrological cycle, it could be considered as a second source of water rather than an alternative resource.

Ground water recharge	Equivalent to
150mm	3,350 MLD

Source: LUAS



**JMG** is an agency that provides technical advisory services and expertise in minerals, geosciences, mining and quarries

All ground water abstraction is regulated by LUAS. Users must get a license from LUAS pending technical approval from Jabatan Mineral dan Geosains (JMG), which serves as a technical advisor. It is LUAS' role to ensure that abstraction is properly managed, while JMG advises on the volume and manner in which the abstraction is being done.

As of 2011, there are 65 ground water abstraction license holders registered with LUAS in the Sg. Klang basin, with more than 200 ground water wells.

	2009	2010	2011
Number of ground water licensees	60	72	65

Source: LUAS 2012

### Issue & Action To Take

Ground water specialists talk about the need to think about regulation of the ground water industry. It is critical to regulate ground water activity at an early stage. Once there are a large number of unregulated ground water users, the industry will become difficult to control and initiate reforms.

A stopgap measure to safeguard against unbridled abstraction of both surface and ground water is being drafted as the *Abstraction of Water Source (State of Selangor) Regulations 2012* under the *Selangor Waters Management Authority Enactment 1999*. The regulations empower LUAS to control the volume and manner of abstraction of ground and surface water.

**Alternative Water Resources.** The Selangor state government has a policy of providing at least two month's reserve of alternative water

resources as well as three to four month's reserve of existing reservoirs. Ensuring the alternative water reserves is an Alternative Water Resource Committee that manages water resources such as ground water and waters from ponds, lakes and ex-mining ponds.

Alternative Water Resource Committee	
Chairperson	Director of LUAS
Secretariat	LUAS
State government dept	JPS, JMG, JKNS, MMD, local authorities, and district and land offices
Water concessionaires	SYABAS, SPLASH, PNSB and ABASS
Others	Permodalan Negeri Selangor Berhad (PNSB), Kumpulan Darul Ehsan Berhad (KDEB) and Perbadanan Kemajuan Pertanian Selangor (PKPS)

Source: LUAS 2012

## LAKES AND EX-MINING PONDS

There are 28 lakes and ex-mining ponds in the Petaling district. Most of the ponds are under private ownership, with only one, Kolam Buaya, being government property. As they are private property, most of the ponds have not been thoroughly tested for water quality.

Item	Pond	Location	Hectare
1	Kolam Buaya Puchong	Kg. Seri Aman	30.00
2	Kolam Hudges	Puchong Batu 11	40.00
3	Unitin Sdn. Bhd.	Puchong Batu 11	164.49
4	Kolam PNSB (Prima Nova)	Puchong Batu 14	300.00
5	Kolam MBF	Puchong Batu 12	45.00
6	Kolam Pakatan Perak (YTL)	Puchong Batu 12	15.00
7	Tetuan Tenaga Gagah	Bandar Sunway	30.00
8	Tetuan Sanjung	Bandar Sunway	30.00
9	Sunken City	Bandar Sunway	40.00
10	Sunway Lagoon	Bandar Sunway	60.00
11	Subang Ria	Lake View	20.00
12	Kolam Seri Serdang	Sri Serdang	10.00
13	Tasik Mines Resort City 1		155.00

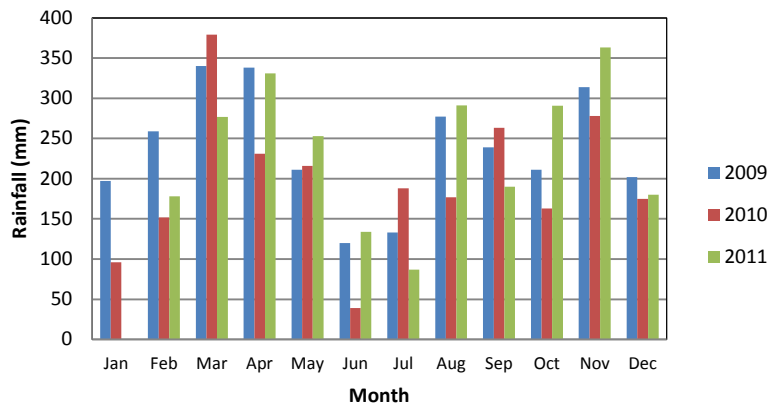
14	Tasik Mines Resort City 2		75.00
15	Tasik Serdang Raya		4.00
16	Tasik Mas Manis		20.00
17	Lakes within UPM		35.00
18	Kelab Golf Seri Selangor		10.00
19	Kolam MAIS		6.00
20	Tasik Taman Jaya	Amcorp Mall	10.00
21	Kolam Susunan Baru	Kg. Medan	25.00
22	Kolam PKNS (Kelana Seafood)	Kelana Jaya	20.00
23	Tasik Dagang	Petaling Jaya	35.00
24	Tasik Taman Aman	Sek. 22, Petaling Jaya	15.00
25	Tasik Taman Shah Alam	Shah Alam	35.00
26	Wetland SUK	Shah Alam	8.00
27	Loji JBA, Seksyen 9		53.00
		<b>TOTAL</b>	<b>1,290.49</b>

Source: LUAS 2012

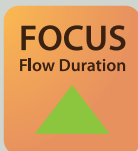
## RAINFALL PATTERNS

Rain has an impact on water resources in that stormwater carries heavy loads of pollution during the initial stages of rainfall, or first flush. In addition, intense and heavy rainfall contributes to erosion along the riverbanks, contributing to high turbidity. Shown below is the total monthly rainfall at the station at JPS Wilayah for years 2009 to 2011.

**STN 3116004 at JPS Wilayah  
Total Rainfall for 2009-2011**



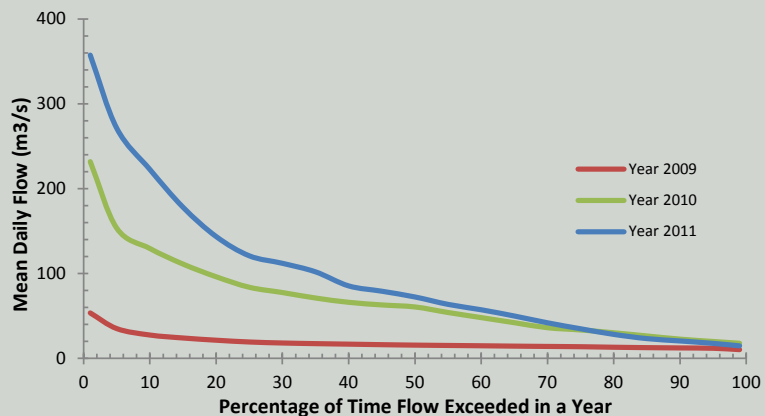
Source: JPS 2012



### Indicator 1: Availability of Water in Sg. Klang

One of the ways to assess water availability is to observe whether there is sufficient stream flows within the river regime. This can be done by observing the mean daily flow over a year. The mean daily flow indicates the mean volume of water flowing through the river throughout the year. It is a good indication of water availability for water budgeting purposes.

#### Flow Duration Curve for Sg. Klang at Jambatan Sulaiman



Source: Bahagian Hidrologi dan Sumber Air, JPS

From the flow duration curve plotted for 2009, 2010 and 2011, one can observe that more water in the river was available in 2011 than in 2009 and 2010. For example, 180 m<sup>3</sup>/s water flowed through Sg. Klang for 20% of the time in 2011; 120 m<sup>3</sup>/s flowed for the same time in 2010 and 35 m<sup>3</sup>/s in 2009. After extracting the water reserved for environmental flow and allocated abstraction uses, the remaining water is what planners and users can budget for other uses, such as river-related projects and activities.

# WATER CONSUMPTION AND ABSTRACTION

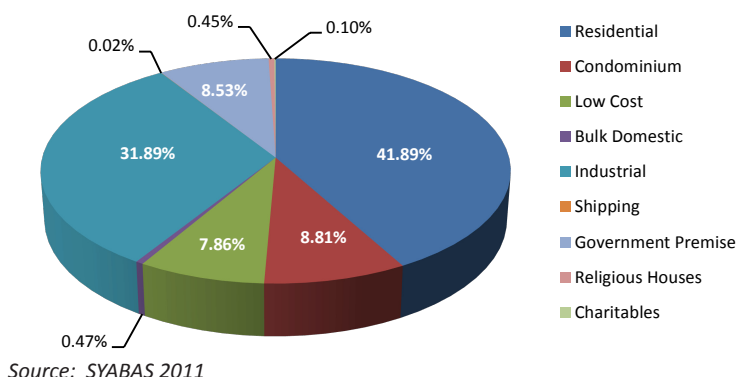
*Water consumption* is the amount of potable water billed to the consumers. The consumption for Petaling, Hulu Langat, Klang and Gombak districts in the Sg. Klang catchment in 2009 was 728 million m<sup>3</sup>. This includes domestic (residential, condominiums, low cost and bulk domestic), non-domestic (industrial and shipping), and others. The figure was 750 million m<sup>3</sup> in 2010, and 755 million m<sup>3</sup> in 2011.

Year	Water Consumption (M)
2009	727.92 m <sup>3</sup>
2010	749.58 m <sup>3</sup>
2011	755.30 m <sup>3</sup>

*Source: SYABAS 2012*

As the pie chart for water consumption recorded by SYABAS in 2011 shows, the biggest consumer of water was the residential sector (residences, condominiums and low cost housing), followed by industrial sector. The water consumption allocation among the sectors varies slightly from year to year between 2009 and 2011.

**Water Consumption in Sg. Klang for 2011**



Starting in 2008, the Selangor State Government has been providing 20m<sup>3</sup> of free water monthly for domestic usage for residents of the state. Only consumers who receive water bills directly from SYABAS via individual meter are entitled to this discount.

## ABSTRACTION OF SURFACE AND GROUND WATER

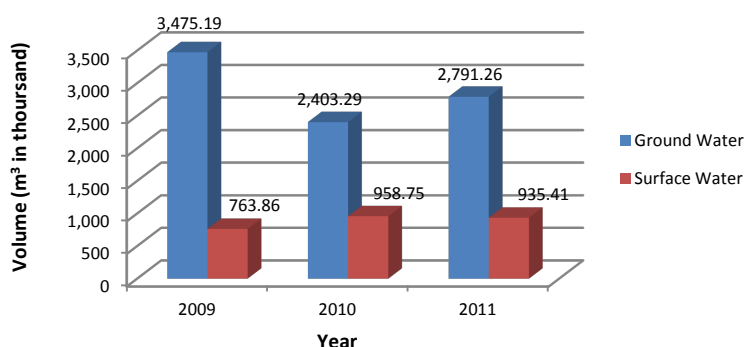
*Abstraction* is the amount of water extracted by users such as water concessionaires, industries and private end users within the catchment. *Surface water* is water from rivers and water bodies such as lakes, ponds, wetlands, coastal waters and other natural or artificial bodies of water, while *ground water* is water extracted from below the earth's surface.

Tighter control over abstraction of surface and ground water is being gazetted whereby licensing of abstractors, conditions and requirements for abstraction, and monitoring and declaration of amount abstracted can be closely managed by LUAS. Any infractions in requirements shall be met with corrective or punitive measures by LUAS.

For all three years—2009, 2010 and 2011—more ground water licensed by LUAS was abstracted than surface water. In 2009, ground water abstraction within the Sg. Klang basin was 3.5 million m<sup>3</sup> while in 2010 the figure dropped to 2.4 million m<sup>3</sup> in 2010 and rose to 2.7 million m<sup>3</sup> in 2011.

In contrast, the amount of surface water abstracted under license by LUAS was less, at approximately 764,000 m<sup>3</sup>; 959,000 m<sup>3</sup> and 935,000 m<sup>3</sup> in 2009, 2010 and 2011 respectively.

**Comparison of Licensed Ground and Surface Water Abstracted within the Sg. Klang Basin**



Source: LUAS 2012

## ABSTRACTION FROM SURFACE WATER

In Selangor, approval from LUAS is required before water can be abstracted. LUAS carries out monitoring and enforcement to ensure that premises and factories that abstract ground and surface water resources are registered with LUAS. This is to ensure that all the conditions stipulated in the license are complied. The ultimate goal is to control the use of water in a holistic and integrated manner.

LUAS imposes a charge for water abstracted from all water resources. Revenues from abstraction go towards the conservation of water resources and environment. Water abstracted for commercial use is RM0.05/m<sup>3</sup>, while water for domestic supply purposes is RM0.01/ m<sup>3</sup>.

Water Abstraction	Rates
Commercial	RM 0.05 /m <sup>3</sup>
Water Supply	RM 0.01 /m <sup>3</sup>

Source: LUAS 2011



**SYABAS** is the state's water distribution company

Syarikat Bekalan Air Selangor Sdn. Bhd. (SYABAS) is the distributor of potable water to the consumer. Water extraction and treatment is carried out by Puncak Niaga (M) Sdn. Bhd.

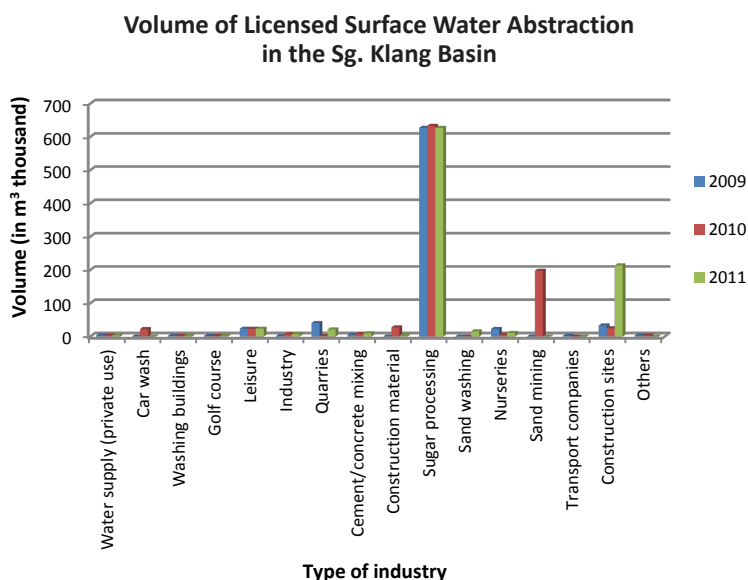
In 2009, the amount of water abstracted from rivers was 19 million m<sup>3</sup>. In 2010 the number increased to 32 million m<sup>3</sup>, and in 2011 the number shot up to 112 million m<sup>3</sup>.

No	Water Treatment Plant	Design Capacity (MLD)	2009	2010	2011
			Abstraction (m <sup>3</sup> in millions)		
1	Bukit Nanas	145.00	0	0	45.63
2	Sg. Batu	113.70	0	0	40.65
3	Wangsa Maju	45.00	2.02	14.65	N/A
4	Gombak	31.37	9.99	10.32	6.49
5	Ampang Intake	18.00	6.46	6.99	8.55
6	Sg. Rumpit	2.30	0.44	0.31	0.45
7	Klang Gates Dam	N/A	0	0	10.12
<b>Total</b>		<b>355.37</b>	<b>18.91</b>	<b>32.28</b>	<b>111.87</b>

*Water abstracted from the Sg. Klang basin*

*Source: LUAS 2012*

A total of 154 licenses for ground water and 137 licenses for surface water abstraction were issued in 2011 throughout Selangor by LUAS. In the Sg. Klang basin, sugar processing plants were the biggest abstractors of surface water (627,000 m<sup>3</sup> in 2011), followed by construction sites (213,428 m<sup>3</sup> in 2011) and riverine sand mining (197,622 m<sup>3</sup> in 2010).



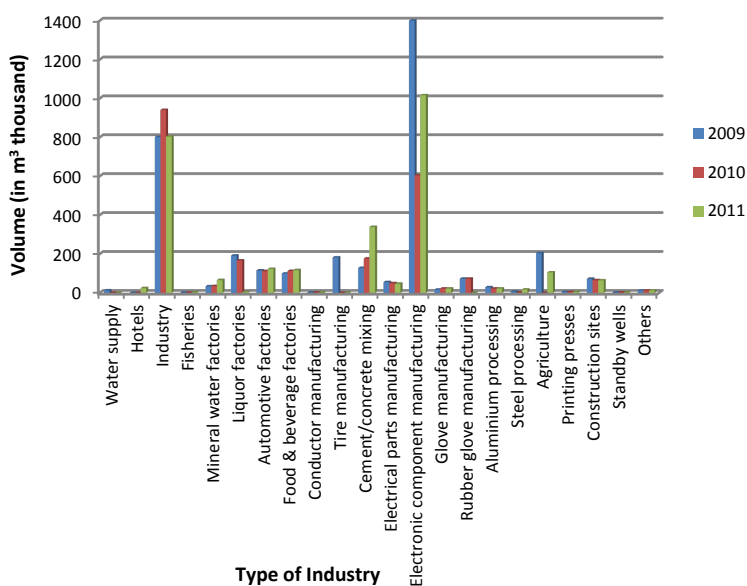
Source: LUAS 2012

In comparison to the three main abstraction activities, other activities abstracted less water such as quarries (20,856 m<sup>3</sup> in 2011), leisure (23,240 m<sup>3</sup>) and sand washing (15,360 m<sup>3</sup>).

## ABSTRACTION FROM GROUND WATER

The users are mostly industrial, with the biggest consumer of ground water being electronic component manufacturing (1.0 million m<sup>3</sup> in 2011), followed by general industry (803,646 m<sup>3</sup>) and cement mixing/concrete (338,656 m<sup>3</sup>). Other notable abstractors are food and beverage factories (116,508 m<sup>3</sup>), automotive factories (122,640 m<sup>3</sup>) and agriculture (105,120 m<sup>3</sup>).

**Volume of Licensed Ground Water Abstraction  
in the Sg. Klang Basin**

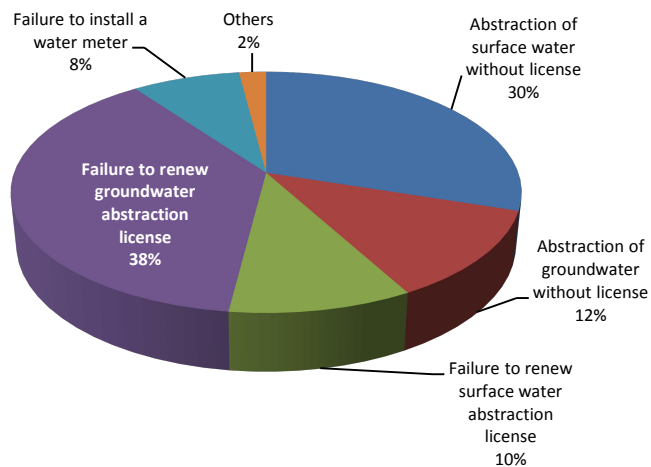


Source: LUAS 2012

### Issues & Action Taken

In 2011, LUAS issued 144 violation notices for commercial water abstraction. Abstraction of water accounted for 60% of notices issued by LUAS. The violations are due to abstraction of surface water without license (30%), abstraction of ground water without license (12%), failure to renew surface water abstraction license (10%), failure to renew ground water abstraction license (38%), failure to install a water meter (8%), and others (2%).

### Water Abstraction Violation in Selangor



Source: LUAS 2012

## SUSTAINABLE WATER PRACTICES



**NAHRIM** is an R&D institute on water resources, rivers and coastal and water quality



**DBKL** is the local authority for the Federal Territory of Kuala Lumpur

**Rainwater harvesting.** The state government promotes sustainable water usage by encouraging the use of rainwater harvesting system throughout all the districts in Selangor. Likewise, JPS is also promoting its use.

Some of the locations where rainwater harvesting has been implemented extensively are the National Zoo in Hulu Klang, bungalow housing developments in Gombak, and mosques in Hulu Klang and Shah Alam. The National Hydraulic Research Institute of Malaysia (NAHRIM) has carried out a study for implementation of rainwater harvesting for non-potable household uses in Taman Wangsa Melawati.

Since 2008 Dewan Bandaraya Kuala Lumpur (DBKL) has made it compulsory for all individual residential houses to install a rainwater harvesting system with holding capacity of 3 m<sup>3</sup> for bungalows and semi-detached houses and systems with holding capacity of 1 m<sup>3</sup> for terrace houses.

As of 2010 all development, irrespective of building type, are required to provide a rainwater harvesting system with minimum capacity of 30% of the Site Storage Required (SSR) volume, which is calculated using recommended MSMA procedures.

In the same year, DBKL approved rainwater harvesting systems in 16 big- and medium-scale developments and 55 small-scale developments, and in 2011 gave approval for 93 big- and medium-scale developments and 67 small-scale developments.

LUAS is also proposing rainwater harvesting at Surau Al-Husna in Section 20, where rain water will be used for flushing toilets, general cleaning and watering plants.



*Surau Al-Husna, Section 20, Shah Alam  
Source: LUAS 2012*

# WATER QUALITY



**JAS** is an environmental protection agency that monitors and regulates air quality, river, ground water and marine water quality, noise pollution and climate change

Jabatan Alam Sekitar (JAS) Selangor continuously monitors the quality of river water, marine water, and ground water to detect and quickly address any changes in the environment that may have a negative impact on humans as well as the environment.

Overall within the state of Selangor, there are 44 water quality stations monitoring the rivers. There was an increase in the number of clean rivers in Selangor in 2010, i.e., 16 rivers (36.4%) as compared with 12 rivers (27.3%) in 2009.

Within the Sg. Klang river basin, there are 6 JAS monitoring stations along the major rivers and tributaries for water quality. In particular, rivers in the Buloh and Sg. Klang subcatchments are monitored. These stations monitor six parameters, which are biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammoniacal nitrogen ( $\text{NH}_3\text{-N}$ ), pH, dissolved oxygen (DO), and suspended solids (SS).

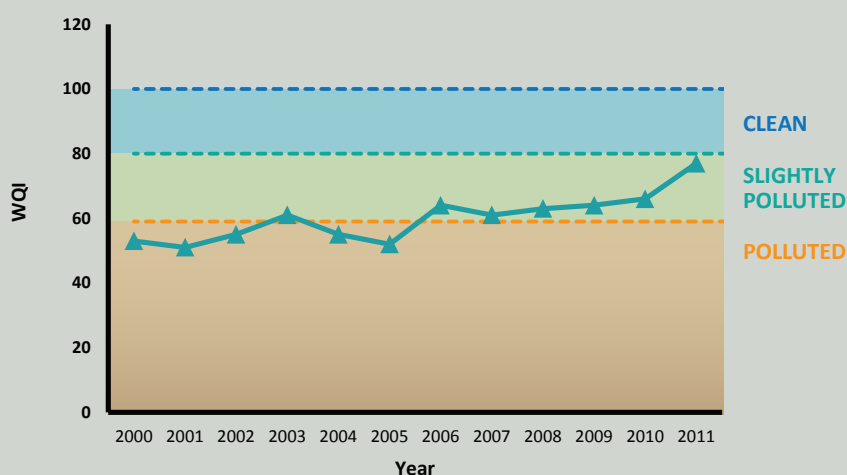
*Water Quality Index*, or WQI, indicates how polluted is the water in a river. It is a weighted average of various pollutants, called *parameters*, to make it easier to classify the river according to quality levels. (Refer to Appendix A for details on the WQI and classifications).



### Indicator 2: Water Quality in Sg. Klang

The WQI for Sg. Klang in 2011 showed a marked improvement over the previous years. Since 2007 the water quality has shown an upward trend. In 2011, the WQI was 77, an improvement of 20% and 17% over the WQI of 64 in 2009 and 66 in 2010. This is due in part to the river engineering works that had started in 2010 under the ROL programme that included the installation of gross pollutant traps along the tributaries and along the main banks of the upper Sg. Klang.

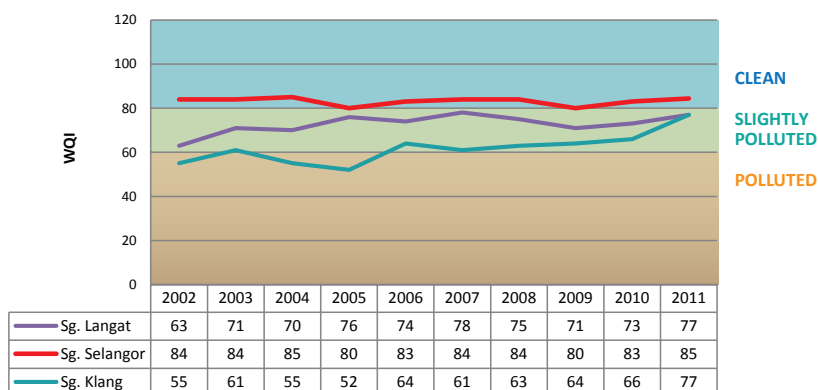
**Water Quality Index for Sg. Klang River Basin 2011**



Source: JAS Selangor 2011

In comparison with the Sg. Langat and Sg. Selangor river basins, Sg. Klang was the most polluted prior to 2006. However, in 2006, there was a spike in WQI improvement. From 2007 onwards, there has been a trend of marked improvement in the water quality. The table below shows a comparison among the three river basins.

### WQI Trends of River Basins in Selangor from 2000 to 2011

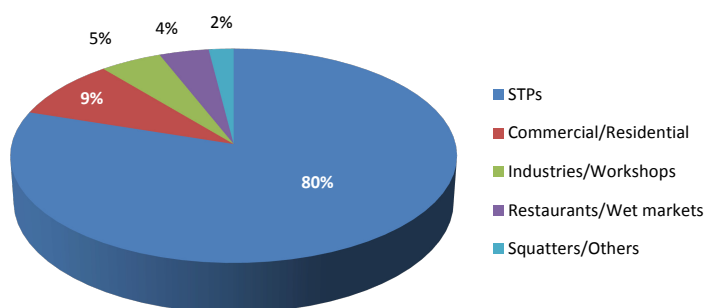


Source: JAS Selangor 2012

According to Puncak Niaga, the water quality at the intakes in the upper reaches of the basin is Class I or II. However, downstream of Sg. Klang, the water quality worsens.

The main culprits fouling Sg. Klang are effluents from sewage treatment plants (80%), commercial and residential centres (9%), industries and workshops (5%), food industries, restaurants, and wet markets (4.2%) and squatters and others (1.8%).

### Sources of Pollution in Sg. Klang



Source: The Star, May 2012

***Other indicators***

WQI gives an average measurement of the water quality of the river. To identify specific problems existing in the river, it is necessary to look at the individual parameters.

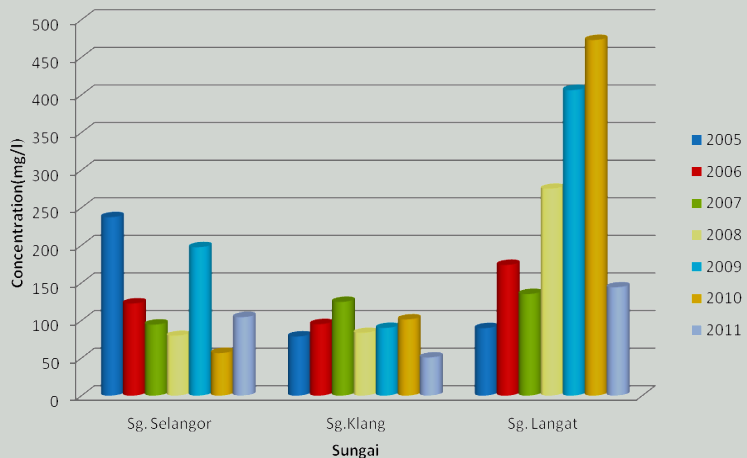
**Total Suspended Solids**

Total suspended solids (TSS) are small solid particles which remain in suspension in water. It is used as one indicator of water quality. TSS is important to measure as pollutants and pathogens are carried on the surface of particles. The smaller the particle size, the greater the total surface area per unit mass of particle, and so the higher the pollutant load that is likely to be carried.

***Indicator 3: Total Suspended Solids in Sg. Klang***

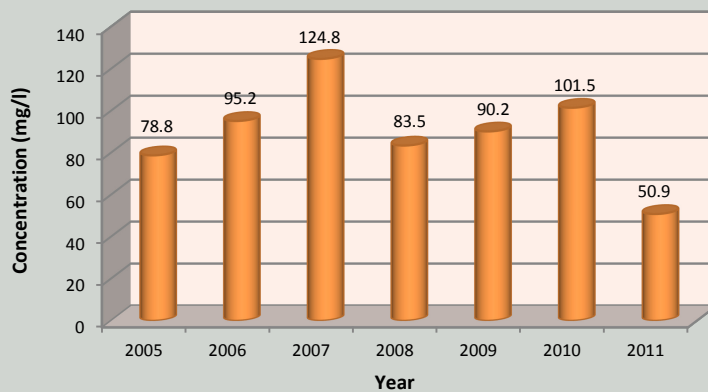
In the year 2010, the level of pollutant concentration for the parameter TSS in Sg. Klang rose over the previous year. Activities that contributed to the rise in concentration levels were river bank erosion, earthworks, and dredging.

A comparison of TSS levels in other river basins shows that Sg. Langat fared the worst in terms of turbidity. In 2010, the SS level was more than four times the level in Sg. Klang and eight times the level in Sg. Selangor.

**Trendline Comparison of TSS Among River Basins**

Source: JAS Selangor, Laporan Tahunan 2011

In 2011, the TSS level in Sg. Klang had the lowest level since 2005 and went down to 5.9 mg/l, which is the lowest within the last six years.

**Trendline for TSS in Sg. Klang from 2005 to 2011**

Source: JAS Selangor 2011

### Ammoniacal Nitrogen

Depending on temperature and pH, high levels of ammoniacal nitrogen ( $\text{NH}_3\text{-N}$ ) can be toxic to aquatic life. High concentrations can stimulate excessive aquatic production and indicate pollution. Sources of  $\text{NH}_3\text{-N}$  include fertilisers, human and animal wastes and by-products from industrial manufacturing processes.

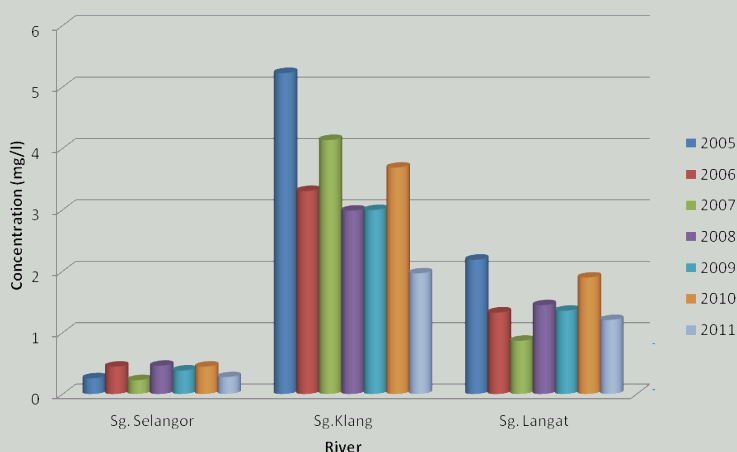


#### **Indicator 4: Ammoniacal Nitrogen in Sg. Klang**

Concentration levels for  $\text{NH}_3\text{-N}$  in Sg. Klang showed an increase from the previous year.  $\text{NH}_3\text{-N}$  is a measure of the amount of ammonia, a toxic pollutant often found in landfill leachate and in waste products, such as sewage, liquid manure and other liquid organic waste products. For the Sg. Klang, the main causes of the increase are from the release of untreated sewage or partially treated effluents.

Comparison among the river basins shows that the Sg. Klang basin has the highest levels of  $\text{NH}_3\text{-N}$ .

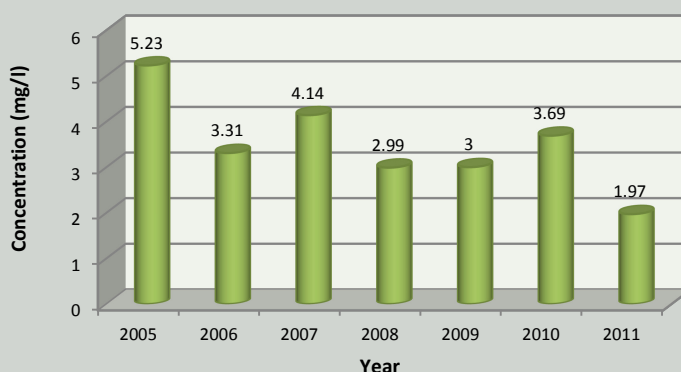
**Trendline Comparison of  $\text{NH}_3\text{-N}$  Among River Basins**



Source: JAS Selangor, Laporan Tahunan 2011

However, the trend for  $\text{NH}_3\text{-N}$  has been decreasing since 2005, with 2011 being the lowest at 0.20 mg/l.

**Trendline for  $\text{NH}_3\text{-N}$  in Sg. Klang from 2005 to 2011**



Source: JAS Selangor, 2011

### Biochemical Oxygen Demand

Biochemical oxygen demand (BOD) is the amount of oxygen required by microorganisms to decompose organic matter in water that is polluted by, for example, sewage.

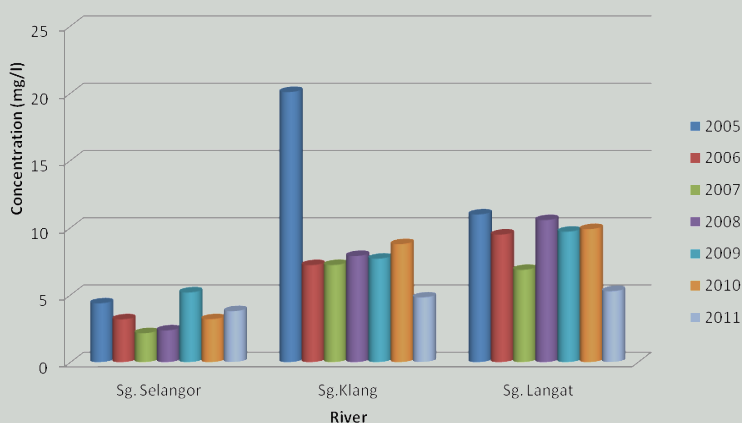


#### **Indicator 5: Biochemical Oxygen Demand in Sg. Klang**

BOD level during the year 2010 showed an increase from that in 2009. High BOD levels indicate a high amount of oxygen needed by bacteria and other microbial organisms, which deprive fish and other aquatic life of the same source of oxygen. The main focus of wastewater treatment plants is to reduce the BOD in the effluent discharged to natural waters.

A comparison of BOD levels among the river basins showed a spike in Sg. Klang in 2005, although it decreased to levels less than those of Sg. Langat in subsequent years.

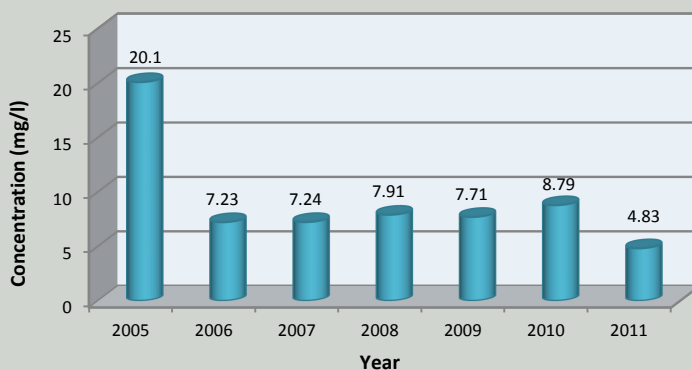
Trendline Comparison of BOD Among River Basins



Source: JAS Selangor, Laporan Tahunan 2011

As with the two previous parameters, the trend for BOD shows that it decreases to 4.83 mg/l in 2011.

Trendline for BOD in Sg. Klang from 2005 to 2011



Source: JAS Selangor, 2011

### Chemical Oxygen Demand

Chemical oxygen demand (COD) is a measure of the oxygen required to oxidize all compounds in water. This includes both organic and inorganic compounds.

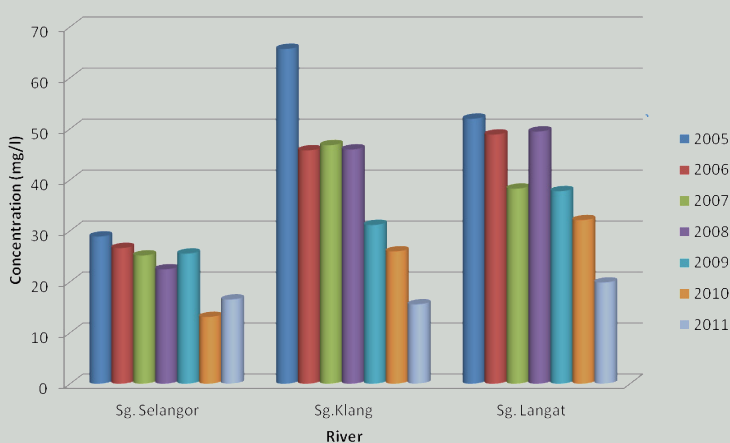


### Indicator 6: Chemical Oxygen Demand in Sg. Klang

In 2010 there was an increase in the COD level in Sg. Klang. COD is an indicator of the quality of effluents and wastewaters prior to discharge. COD level is often used in monitoring and control of discharges, and for assessing treatment plant performance.

Among the three river basins, Sg. Klang showed a high level of COD in 2005.

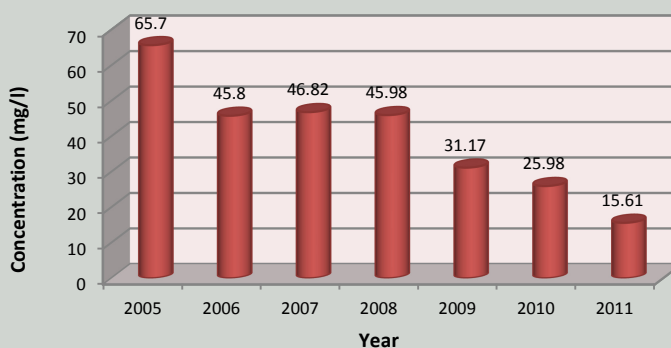
#### Trendline Comparison of COD Among River Basins



Source: JAS Selangor, Laporan Tahunan 2011

However, the trend of the last six years has been a decrease in COD levels, with 2011 being the lowest.

#### Trendline for COD in Sg. Klang from 2005 to 2011



Source: JAS Selangor, 2011

### Issues

Lack of financial resources for the upgrading of sewage treatment plants (STPs) is the major cause of water quality problems in the Sg. Klang basin. Attaining Class IIB water quality level for downstream sections of Sg. Klang will require upgrading of the STPs and the sewer system that will include nitrification and polishing of treated effluents by filtration.

In addition, sedimentation due to runoff from earthworks of large-scale housing development has contributed to high turbidity readings along the upper section of the basin.

The highest number of violations was recorded in year 2009 (1,485 violations), possibly due to pressures from development and lack of environmental awareness as well as changes in weather. In 2010, the total number of violations decreased slightly (1,319) due to a decline in the number of violations for parameters related to total coliform, turbidity, BODs, ammoniacal nitrogen, TDS, manganese, lead and cadmium. In 2011, a total of 1,085 raw quality violations were recorded at the water intakes for 11 parameters.

### Actions Taken

**River Improvement Works.** Raising the river water quality from the current Class III – Class IV (not suitable for body contact) to Class IIB (suitable for body contact and recreational use) is one of the main goals of the ROL project. To this end, works to clean up Sg. Klang in the upper reaches and central Kuala Lumpur have started in May 2011. Some of the works being done are water treatment plant on Kerayong River at Cheras and the beautification of the bank of the Gombak River in Selayang.

Strategies for river improvement under the ROL include better treatment of sewage, processing of wastewater from wet market, installation of gross pollutant traps in main drains, treatment of water in flood retention ponds before releasing downstream, building of facilities to filter and treat river water, trapping greasy waste in food courts, reducing pollution from squatters, preventing industrial discharge, upgrading drainage and stormwater systems, preventing erosion from urban development and improving rubbish disposal.



**SYABAS** is Selangor state's water distribution company

**Monitoring.** Monitoring is also key to improving water quality. JAS is joined by other agencies and private entities such as Syarikat Bekalan Air Selangor (SYABAS), LUAS, and Jabatan Kesihatan Negeri Selangor in conducting sanitary surveys and monitoring. Data gathered and relevant information is centralised at LUAS so that an integrated, concerted effort towards enforcement, issues resolution and problem solving can be made.



Source: LUAS 2012

### ***Water Quality of Coastal Waters***

LUAS, through the Port Klang Coastal Strategy Implementation Plan, mandates the development of mechanisms to minimize the level of water pollution and research new options for control and prevention of water pollution. The Plan also calls for water quality data to be updated regularly and marine water quality standards to be set as well as setting up of objectives that link marine water quality with impacts from adjacent land use.

JAS has set up monitoring stations in estuaries and coastal areas to observe marine water quality for purposes of recreation, fishing and marine parks.

The stations are located at Pulau Ketam and Pulau Lumut. Along the coastline, the marine water quality recorded high levels of *E. coli*. In

particular, the readings were concentrated where there was discharge of wastewater from eateries, restaurants and domestic waste that were not adequately treated.

Overall, the concentration of pollutants in marine waters around the islands were below the Interim Marine Water Quality Standards, with the exception of E.Coli.

*Fishing activities are marred by littering near the Batu Dam*





# RIVER AND COASTAL ECOLOGY

## ***Coastal Ecology***

The coastal areas of Port Klang and its islands are habitats for many birds and plants. There is an area in Kapar, which has become a transit point for migratory birds from the continent of East Asia during certain seasons. These and other bird species thrive where there are mangroves, which are plants that grow in swampy or coastal areas where the river waters meet the sea.

Apart from providing shelter for birds and many commercial fishery resources such as shrimps, crabs and fish, the mangrove ecosystem acts as flood regulator, bio-filter of wastes, and carbon storage reservoir. The degradation and decline of habitats directly affects food supply, shelter for marine organisms and wildlife, and livelihood. Mangrove trees help sustain the local population as the wood is used for handicraft products, home construction, furniture and boats as well as serving as sources of fuel such as charcoal and firewood.

Under the Integrated Coastal Management (ICM), a programme run by the Selangor state government and the United Nations Development Programme's Partnerships in Environmental Management of the Seas of East Asia (PEMSEA), the environment and natural resources along the coast are managed holistically. With LUAS as the project manager, Port Klang serves as the site of the National Demonstration Project for ICM and includes the Klang and Kuala Langat districts.

Involving various other stakeholders such as Majlis Perbandaran Klang and Majlis Daerah Kuala Langat, NGOs, government agencies and the private sector, ICM addresses six key policies:

**Policy 1: Water Pollution** addresses the reduction and control of water pollution, provision of funding and technical assistance to build capacity in local government, development of strategies to update water quality data on a regular basis, and development of standards and objectives consistent with those of the Marine Water Quality.

**Policy 2: Habitat Destruction** aims to protect mangroves and coastal forests through awareness and education to the public, replanting programmes, and measures to prevent mangrove and forest destruction.

**Policy 3: Solid Waste** encourages waste reduction, promotes recycling and reuse, develops best practices and technologies including waste disposal facilities, and reducing illegal dumping. This can be achieved through enforcement, partnership and awareness and education initiatives.

**Policy 4: Health** aims to develop preventive mechanisms to minimize health risks, provide incentives for compliance to regulations, strengthen monitoring and enforcement and carry out awareness programmes on public health.

**Policy 5: Sustainable Use of Marine Natural Resources** seeks to protect and restore habitat of wildlife by implementing measures that uses marine resources sustainability and promoting awareness and education on sustainable resource management.

**Policy 6: Erosion and Sedimentation** is aimed at preventing siltation along the coast, reducing loss of sand along the coast, stabilising the coastline through eco-engineering, reducing erosion by locating structures away from the shoreline, focus on the social impact of sedimentation and erosion, and creating better understanding of coastal zones.

Some of the actions and programmes undertaken by LUAS under the ICM include monitoring visits to shrimp farms for effluent discharge, replanting of mangrove trees, and monitoring along the coastline for excessive use of natural resources.

Although many of these areas have been gazetted as forest reserve to preserve their ecosystems, there have been cases where these habitats have been degazetted for development purposes. Studies have shown that declining mangrove habitats due to extensive development will have adverse impacts on the fishing industry in terms of decreasing amount of fish catch. Loss of mangrove forests are significant as mangroves serve as fish breeding grounds, give refuge of diverse wildlife and supply wood.

According to the Jabatan Perikanan Selangor (DOF), pollution in the rivers has also had a negative impact on the growth of the fish and disrupts the natural breeding location of certain fish species.



*Mangrove thicket by a rural village on Pulau Indah*



*Aquatic life such as mudskippers thrive unseen along the coast of Sg. Klang*

### River Ecology

There are 27 species of birds found within the basin. Herons, egrets, kites, eagles, doves, kingfishers, bulbuls, orioles, and swifts are some of the bird species that frequent the waters of Sg. Klang.

Flamingos and milky storks are also spotted along the upper reaches of the Sg. Klang basin along Ulu Klang from Sg. Batu and Taman Melawati down to the confluence of Ampang and Sg. Klang. These birds use the river as resting areas and are sometimes found feeding on the fish in the river or preening themselves.

Indah Water Konsortium's ponds and lagoons are becoming an inviting place for migrating birds, particularly storks and egrets. Egrets and its cousins, herons, are mostly white in colour and belong to a species from the *Egretta* or *Ardea* family. Egrets are long-legged with long necks. It is believed that they are interested in the fish, insects, and earthworms within Indah Water's compounds.

Fish are also found in oxidation ponds, aerated lagoons, and clarifiers. Typical fish found in the ponds that may have come into sewerage systems during floods or heavy rain, are known as black tilapia or the *tilapiine chichlid* tribe of the *chichlidae* family species.



**PERHILITAN** is an agency that protects, manages and preserves biodiversity



*Egrets*



*Milky Stork*



*Black tilapia*

Elsewhere in the basin, there are 14 mammalian species that can be observed, including the Common Treeshrews, Plantain Squirrels, Ricefield Rats, Leopard Cats, Common Palm Civets, Smooth Otters, and macaques. In terms of fauna, the most abundant tree species are pokok nipah, pokok api-api, pokok berembang, pokok pucuk paku, and pokok ara.

### *Interesting Fact: Flora and Fauna in Sg. Klang*

In 2009, LUAS through its QUA QUA programme started an initiative that monitors invertebrates in various river basins throughout Selangor. In the Sg. Klang river basin, the monitoring was carried out in Sg. Gombak. The objective of the programme was to count the number of invertebrate species in the river and monitor for changes in the diversity composition. The existence of these species also gave an indication of the water quality, as these invertebrates are sensitive and can only survive in clean water at Class I or II level.

The counting was done by groups of participants ranging from schoolchildren to teachers to community members. The benefit of the programme was that participants were able to see the relationship between clean water and existence of river life.

Listed below are the numbers of species that were counted in Sg. Gombak from the years 2009 to 2012. Each number represents a group of invertebrates, so the actual population is larger than the figure listed.

Species	Count
Nymphs	
Stonefly Nymphs	25
Flattened Mayfly Nymphs	15
Spiny crawling mayfly nymphs	7
Dragonfly nymphs	10
Damselfly nymphs	19
Larvae	0
Caddisfly larvae with sand/gravel cases	0
Common net-spinner larvae	5
Dobsonfly larvae	11
Beetle larvae	5
Crustacea	0
River prawns	20
Freshwater shrimps	18
River crabs	9
Insects	0

Adult beetles	15
Water bugs	7

Source: LUAS 2011



Macroinvertebrate found along the river bank of Sg. Gombak

Source: LUAS 2011



# RIVER-RELATED ACTIVITIES AND SOURCES OF POLLUTION

While human activities along the river bring economic and social benefits to humans, uncontrolled activities also wreak harmful effects. Some of the negative impacts that the activities have incurred along Sg. Klang are increased frequency of flooding, decreasing water quality, environmental degradation, sedimentation along riverbanks, soil and riverbank erosion and encroachment of river reserve.

The sources of the impacts have been identified as agricultural activities, livestock farms, squatter areas, illegal dump sites, automotive workshops, discharge from factories, earthwork and development activities, discharge from housing estate and individual septic tanks, industrial waste and construction waste.

For incidents arising from any pollution sources, there are two institutional set-ups comprising various state agencies. One is called the *Sungai Klang Pollution Control Task Force* for regular monitoring and control, while the other is the *State Water Resources Pollution Emergency Committee* for emergency and incident response.

The Sungai Klang Pollution Control Task Force was formed in March 2008 to investigate reports of point and non-point pollution within the catchment.

#### **Sungai Klang Basin Pollution Control Task Force**

**Chairperson**

Director of LUAS

<b>Secretariat</b>	LUAS
<b>Committee Members</b>	SPAN, JPP, JPBD, JMG, JPV, UPEN, JAS, JPS, JKNS, DOA, JPNS, district and land offices, local authorities, SYABAS, PNSB, IWK

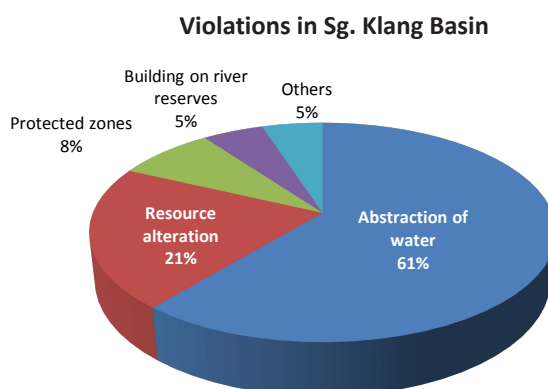
Source: LUAS 2012

Severe cases of river pollution are immediately responded to by the State Water Resources Pollution Emergency Committee. This setup enabled quick response and cleanup of several cases of river pollution during 2009 and 2011.

<b>Selangor State Water Resources Pollution Emergency Committee</b>	
<b>Chairperson</b>	Chairman of the Selangor Infrastructure and Public Amenities Standing Committee
<b>Secretariat</b>	LUAS
<b>Government Departments</b>	JAS, JPS, JKNS, JKR, local authorities, district and land office, other related agencies
<b>Water Concessionaires</b>	SPLASH, PNSB, ABASS and SYABAS
<b>Highway Board and Concessionaires</b>	Lembaga Lebuhraya Malaysia MTD Prime and PLUS

Source: LUAS 2012

Of the total 238 notices issued in 2011, 74 or 31% were issued for the Sg. Klang basin. The types of violation activities were: abstraction of water (60.5%), resources alteration (21.4%), infringement on protected zones (8%), building of structures on river reserves (5.5%), and others (4.6%).



Source: LUAS 2012

## SEWAGE



**IWK** is a national sewerage company providing sewerage services, operating and maintaining public sewage treatment plants and sewerage pipelines

Domestic sewage refers to wastewater that is discharged from households. Sewage falls into two categories: “black water” from toilets and “grey water” from kitchens, washing machines, and baths. If not properly treated before being discharged into the river, it can severely affect the water quality with organic and pathogenic pollution.

As of 2011, there were 1,013 public sewage treatment plants and 372 network pumping stations in the Sg. Klang basin. Although there is a push towards centralised treatment plants, there are still many individual septic tanks. These plants fall under the operation and maintenance of Indah Water Konsortium (IWK), a public sewerage services operator and sewerage service licensee holder. IWK manages public plants only; those under private ownership are responsible for their own operation and maintenance.

Stations and Plants	2009	2010	2011
Total Network Pump Station (NPS)	243	261	274
Total Communal Septic Tank (CST)	372	372	372
Total Sewage Treatment Plants (STPs)	981	1,003	1,013

Source: IWK 2012

Among the plants, there are different categories depending on effluent discharge requirements. The Environmental Quality Act (EQA) 1974 specifies two standards for effluent discharge: Standard A for discharge upstream of any raw water intake (Catchment A), and Standard B for discharge downstream of any raw water intake (Catchment B). The effluent standard of STPs is then divided into three main categories: Category 1, Category 2 and Category 3. Any STPs constructed before 1 January 1999 is a Category 3 plant, while STPs constructed between 1 January 1999 and 10 December 2009 is a Category 2 plant. STPs constructed after 10 December 2009 is a Category 1 plant.

Type	Qty	PE
<b>Category 1</b>		
Mechanised Cat 1 (STD A)	-	-

Mechanised Cat 1 (STD B)	2	7,194
<b>Total</b>	<b>2</b>	<b>7,194</b>
<b>Category 2</b>		
Mechanised Cat 2 (STD A)	11	152,427
Mechanised Cat 2 (STD B)	352	3,405,507
<b>Total</b>	<b>336</b>	<b>3,557,934</b>
<b>Category 3</b>		
Mechanised Cat 3 (STD A)	4	15,183
Mechanised Cat 3 (STD B)	332	2,016,647
AL (STD A & B)	61	1,769,692
OP (STD A & B)	60	304,376
IT (STD A & B)	218	220,676
<b>Total</b>	<b>675</b>	<b>4,326,574</b>

*Classification of STPs within the Sg. Klang Basin (2011)*

*Source: IWK 2012*

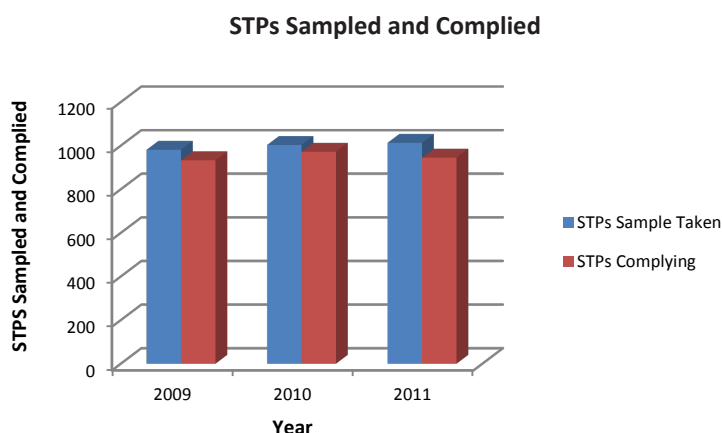
Category 1 is a type of plant that is equipped with tertiary treatment. Tertiary treatment means that the plant can further reduce or remove pollutants beyond the level of common secondary treatment process, such as nitrogen and phosphorus.

Category 2 plants use a common secondary treatment process without the nutrient removal process, while Category 3 plants employ a combination of secondary and primary treatment processes.

In 2009, revisions were made to the 1979 Environmental Quality Regulations. This meant that as of 2010 more stringent requirements and monitoring of effluents were imposed, such as the addition of leachate removal and stricter effluent control for lakes and ponds. The new regulations also added parameters such as ammoniacal nitrogen, nitrate nitrogen, and phosphorus, which suppress aquatic life, produce foul-smelling and cloudy water, and have negative effects on human health. (Refer to Appendix B to see the new regulations).

In addition to operating and maintaining its sewerage assets, IWK monitors its plants to ensure compliance to the new environmental quality regulations. Of the 981 STPs monitored in 2009 statewide, 933

or 95.1% were in compliance with the EQSR 2009; 972 or 96.9% out of 1,003 STPs were in compliance in 2010; and 945 or 93.3% out of 1,013 STPs were in compliance in 2011.



Source: IWK 2012

The reason for the high compliance rate is due to the removal of communal septic tanks (CSTs) and independent septic tanks (ISTs) from IWK's maintenance schedule. Although CSTs are no longer under the IWK's responsibility, the agency continues to monitor CSTs as part of its effluent monitoring effort.

### Issues

In spite of the measures that IWK has taken, it has come under fire as one of the main contributors to pollution within the basin.



Green effluents discharging from an IWK plant along Sg. Klang

Some of the many challenges that IWK has been facing are difficulties in treating oil and grease, ageing infrastructure and illicit connections.

Challenges Facing IWK	Comment
Oil and grease	Many of the STPs are not designed to treat oil and grease
Ageing infrastructure	Some of the older facilities need to be upgraded to regulatory standards
Illicit connections	Cause contaminated wastewater or chemical or toxic substances to enter into sewers or directly into existing standard domestic sewers before receiving treatment from a wastewater treatment plant

Source: IWK 2012

### Actions Taken



**MPAJ** is the local authority for the Ampang Jaya district



**JPP** regulates sewerage services and manages existing sewerage services under public and private ownership



**KeTTHA** is a federal ministry for energy, green technology and water

Several parties are addressing the issues and challenges in sewerage. IWK has been engaged in conducting upgrading works, such as the Taman Seraya sewerage system in Bukit Teratai, Ampang, which was scheduled to be completed by August 2011.

The Office of the Menteri Besar Selangor and Majlis Perbandaran Ampang Jaya (MPAJ) are leading key initiatives towards constructing storm water treatment plants for the drainage system at Taman Melawati and Kampung Fajar. They are also involved in the reduction of pollution from squatters by significantly decreasing sewage, sullage, and rubbish in the Sg. Klang.

Jabatan Perkhidmatan Pembentukan (JPP) is upgrading existing sewerage facilities and expanding regional sewage treatment plants. Two projects—rationalisation of 17 plants and sewer investigation, rehabilitation, realignment and upsizing—are scheduled to be underway. Other works that have started are 16 plants within Selayang to Category 1, property connection at Seputeh, Ampang Hilir, and Titiwangsa, rationalisation of 19 sewage treatment plants in Damansara, and research works on refurbishment of abandoned plants/developments. This key initiative is due for completion in 2019.

Kementerian Tenaga, Teknologi Hijau dan Air (KeTTHA) is restructuring the sewerage services industry through the formation of a Sewerage Facilities Licensee, the National Sewerage Company (NASCO) in

accordance to the Water Services Industry Act 2006. It is also reviewing the sewerage services tariff, which will be implemented in phases, to make the sewerage services sustainable in the long term.

### INDUSTRY

The automotive workshop industry is the biggest in the upper reaches of the Sg. Klang basin, followed by furniture and welding iron industries.



*Rows of automotive workshops and paint shops line the Sg. Klang corridor*

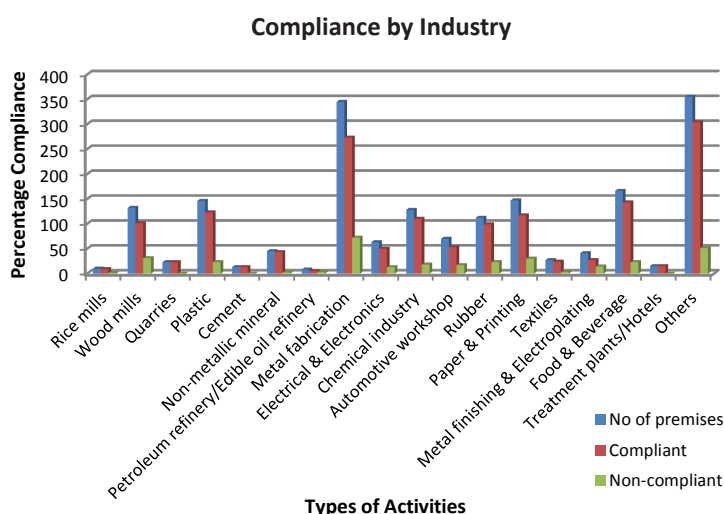
Another concentration of industries can be found downstream in the Klang district, particularly around Port Klang. Industries comprise boat and ship repair factories, warehouse and shipping, bread factories, poultry processing factory, storage and repairing of heavy machinery, train repair factories, rubber glove factories, auto parts factories, rubber processing factories, oil processing factories, and wood and plywood mills.

### *Actions Taken*

The enforcement program run by JAS Selangor in 2011 focused on industries that discharge effluents, including factories that produce crude palm oil. The target compliance rate for manufacturing industries was 70%, while it was 100% for those producing crude palm oil.

JAS conducted 2,133 inspections on 1,846 industrial premises that are subject to the Environmental Quality Act 1974 throughout the state. Out of 1,846 premises inspected, more than 1,522 or 71.4% showed compliance.

Industries that had the highest compliance rate were the quarry industry, water treatment plants and hotels at 100%, followed by non-metallic mineral industry (98.6%) and automotive workshops (98.5%). Industries that had the lowest level of compliance were the cement industry at 92.3%, followed by metal finishing and electroplating (92.5%) and the rubber industry (95.1%). Other industries such as electrical and electronic, wood mills, rice mills and plastic factories ranged between 96% and 98%.



Source: JAS Selangor 2011

Based on enforcement visits carried out in 2011, non-compliance with the 2009 industrial effluent regulation ranged between 80% and 100%. JAS has identified several factors contributing to non-compliance that can be addressed in the future:

Factors for Non-Compliance	
1	Lack of effluent treatment plants, thus allowing direct discharge of raw untreated water into the waterways
2	Performance of effluent treatment plants not at optimal levels
3	Effluent treatment plants operating at levels above actual design capacity
4	Lack of qualified personnel in proper effluent treatment
5	No regular surveillance on the quality of effluent discharge
6	Overall lack of understanding of the new regulatory requirements, the Regulations of the Environmental Quality (Industrial Effluents) 2009

Source: JAS Selangor 2011

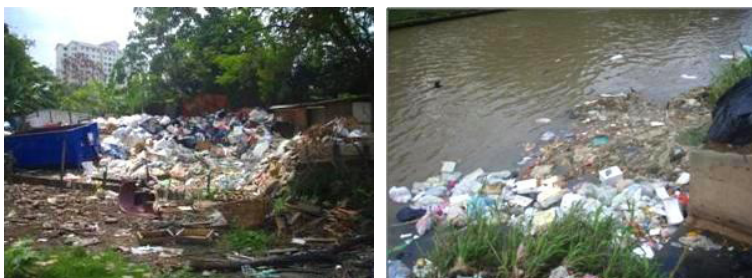
### Commercial Activities

Off the Middle Ring Road 2 in Ulu Klang, scores of polluting businesses such as car workshops line the banks of Sungai Klang. These premises, situated on river reserves, have drains that discharge directly into the river.

Likewise, riverine squatter settlements along the river corridor often foul up streams with trash and raw sewage. To date, stormwater treatment plants at Taman Melawati and Kampung Fajar in Ulu Klang are scheduled to be built under the ROL project.

### SOLID WASTE

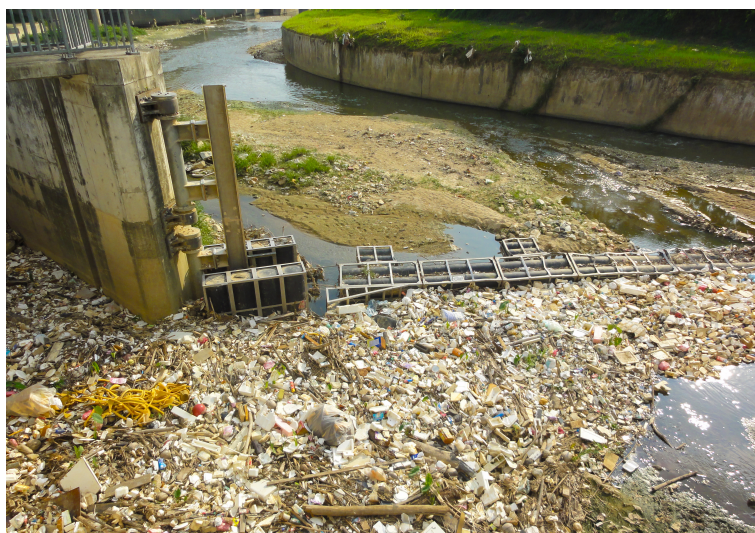
There are no landfills in the Sg. Klang basin although there is a transfer station at Shah Alam with capacity of 1,000 tonnes per day. Most of the problems involving solid waste are generated from illegal dumpsites, with reported cases in Shah Alam, Subang Jaya, and Petaling Jaya.



*Illegal dumping of trash in Petaling Jaya spilling into Sg. Klang*

#### Issues

Solid waste issues in the basin focus predominantly those found in the rivers. Some 77,000 tonnes of rubbish end up in Sg. Klang annually and currently only a third of that is trapped. The volume of solid waste picked up at the log boom at the Pusat Kawalan SMART at the Klang and Ampang river confluence for the year 2009 was 154 barrels, or 1,848 m<sup>3</sup>, equivalent to an area slightly smaller than an Olympic-sized swimming pool.



*Trash accumulated at the log boom at the SMART office along Sg. Ampang*

Under the ROL project, more trash rakes, trash screens and floating booms are being placed along rivers and in flood detention ponds.

### Actions Taken

The Sungai Klang Pollution Task Force gave notices to occupants of the land where the dumping occurred and engaged in cleanup operations together with Majlis Bandaraya Petaling Jaya, Pejabat Daerah Tanah Petaling, JPS Petaling, and Polis Diraja Malaysia.



*LUAS team with local authorities, land office and police supervising cleanup*

Gross pollutant traps or GPTs will be installed in major drains to prevent trash, silt and grease from ending up in rivers. While only a few drains had GPTs in previous clean-ups, the ROL project will have some 300 units.

JPS is involved in the construction of two new automated trash screens, upgrading of existing log booms in the Ampang and Seputih Rivers and construction of GPTs at outlets to the Gombak and Ampang Rivers. Maintenance work is also being carried out on constructed automated trash screen, log booms, and GPTs as well as monitoring water quality.

DBKL will also be installing additional GPTs, floating booms, and static screens. Construction stage is scheduled for completion in 2012.

Another measure is the utilisation of retention ponds from sewage and sullage, which falls under the purview of JPS. Construction works will be carried out at Benteng and Puah Flood Detention Ponds.



**JPSPN** is a government agency dedicated to the management of solid waste

A key initiative is the promotion, enforcement, and management of river cleanliness through general rubbish disposal. The lead agency for this is Jabatan Pengurusan Sisa Pepejal Negara (JPSPN). A significant amount of solid waste ends up in the Klang and Gombak river system, carried by rain and floodwaters as well as via the drainage system. As such, JPSPN is conducting its 3R campaign and implement the Food Waste Plan to reduce the amount of solid waste.

Another initiative will be reducing pollution from squatters by local authorities such as MPAJ.

### ***Spillages***

In addition to solid waste, there are also problems of spillage along highways. To address this, highway concessionaires such as MTD Prime Sdn. Bhd. has installed rail mats and micro surfacing systems along accident-prone routes to improve skid resistance. They have also constructed retention ponds such as the one at KM28 along the Karak-KL Highway designed to trap oil and diesel spills and minimise river pollution.



*GPT installed in Taman Melawati under the ROL project*

### ***Illegal Dumping***

Observation along Jalan Gombak in the Sg. Gombak sub-basin found that solid waste has been disposed indiscriminately at a few sites by the roadside. The main component of the wastes at these sites was found to be non-biodegradable waste such as plastic bags and bottles. In addition to household waste such as furniture, animal carcass was also observed at these dump sites.



*Trash being dumped off a bridge over Sg. Klang*

Factors leading to dumping are the relatively isolated location, proximity to existing waste disposal facilities, and lack of services and recycling programs.

The impact of dumping waste haphazardly is unsanitary breeding ground for *Aedes* mosquitoes and rodents, runoff into the rivers causing pollution and risk to wildlife such as monkeys that may consume poison or toxic material.

### SAND MINING AND QUARRIES

Sand mining is considered alteration of resources and is thus regulated by LUAS. Sand mining is an economic activity that dates back 50 years. There are approximately 19 sand mining locations within the river basin, and the estimated sand yield is 1.4 million tons per year.

Sand mining is often villified as a source of pollution, but it is in fact a basic industry that provides the material for urban development and economic growth. Sand mining along the riverbank can also be an indicator of aquatic life. Deposition of sediments and sand create riffles and slow-moving water at shoals encourages the growth and proliferation of bottom-dwelling life.

It is only when sand mining activities are uncontrolled that sand mining becomes a source of water pollution. There is a set of guidelines called *Sand Extraction Guidelines (Garispanduan Pengambilan Pasir)* prepared by JPS that all sand mining operators must follow.

Year	No of Sites	Location
2009	5	Sg. Damansara, Sg. Pusu, Sg. Cincin, Sg. Gombak, Sg. Kayu Ara
2010	5	Sg. Damansara, Sg. Pusu, Sg. Cincin, Sg. Gombak, Sg. Kayu Ara
2011	6	Sg. Damansara, Sg. Pusu, Sg. Cincin, Sg. Gombak, Sg. Kayu Ara, Sg. Rasau

Source: LUAS 2012

For quarries, JMG provides approval and enforcement. LUAS monitors effluents from quarries and carries out enforcement on violations.

### Issues

A stone quarry operated in Gombak had traces of turbidity which tends to elevate during heavy rainfall due to more surface runoff from the nearby quarry which would be discharged in the river. In 2010, illegal sand mining activities at Sg. Salak and Sg. Gombak resulted in high suspended solids and turbidity which affected the Wangsa Maju WTP intake.

## DEVELOPMENT AND EARTHWORKS

Another major source of pollution in Sg. Klang is sediments from riverbank erosion and earthworks. Soil erosion in the river basin is estimated at 18 metric tonnes per hectare (t/ha) per year, which is equivalent to approximately 2.3 million tonnes of annual soil loss from the entire basin. The major source of erosion is from urbanising areas

(about 660,000 t per year). Much of this occurs on construction sites where large areas of earth are exposed. On some steep lands with over a 10 percent grade, soil losses are often in excess of 400 t/ha per year.

Land-clearing activities for residential development in the upstream areas such as Taman Melawati, Kemensah and Ukay Perdana must be monitored closely for siltation and subsequent shallowing of the river.

There have been reported cases of siltation in Sg. Pusu in the Gombak district due to river bank failure and diversion of a tributary that has reduced it to an 'earth drain'.



*Earthwork at Anak Sungai Batu 3*

**Actions Taken**

The State Government has introduced initiatives for the sustainable use of Sg. Klang. *Projek Pemulihan Pembangunan Sg. Klang* or the Klang River Rehabilitation Project aims to restore and maintain the aesthetic value of the river, improve river management and flood control, develop along the river to increase the economic value of land and create a water-based transportation network.

To this end, the Selangor government has gazetted 50 metres on both sides of Sg. Klang, conducted a land use inventory along the river banks, held carnivals along the river for the general public, and has started rehabilitation and development works.

Some of the planning entailed in this endeavour includes the development of a vision plan for the town of Klang, a former royal town, and a master plan for the Sg. Klang Rehabilitation Project. Also included in the Rehabilitation Project are plans to restructure the water services industry in the state.

One of the key thrust under another initiative, the ROL project, will be targeting erosion from urban development. The Stormwater Management Division of JPS is upgrading the sediment holding pond of Taman Bukit Mulia, Bukit Antarabangsa, and Gombak as well as retrofitting a flood detention pond into a sediment holding pond in Bukit Botak. This initiative is scheduled for completion, including post-construction water quality monitoring and sampling, in 2012.

River banks are being shored up to prevent erosion, which cause the waterways to become turbid. To maintain a natural riverine habitat, JPS is moving away from concrete linings of river banks. At Kampung Sungai Mulia in Gombak, stacks of green terramesh (which are made from coconut husk fibres sandwiched between layers of wire mesh) protect the banks of Sg. Gombak. The terramesh slows down the water flow and allows natural filtration.

Along Sg. Kerayong, “soft rock” is used. These are heavy-duty geotextile bags filled with sand to a weight of two tonnes each. Arranged in stacks along the riverside, they protect the waterway and offer a substrate for vegetation to take root.



*Cells for vegetating the banks of Sg. Klang; terramesh being installed along the banks*

### **Coastal erosion**

Coastal erosion is caused by natural actions of waves and by human activities. Certain areas are seeing the effects of erosion more than others: the coastal zone between Sungai Sementa and Sungai Puloh has eroded as much as 120 to 200 metres since 1963 at a rate of 5 to 7 metres per year. And along the coast of Pulau Indah, sand dredging activities in the surrounding waters for land reclamation purposes have exacerbated erosion of its coast.

In terms of navigation, erosion can cause shallowing of coastal waters and navigational routes of the port, resulting in increased dredging costs to deepen access routes.

Erosion also increases costs to build and maintain beach stabilisation/ protection walls and other coastal structures, as well as disrupts natural flow and drainage, thereby increasing the likelihood of flood upstream in the basin.

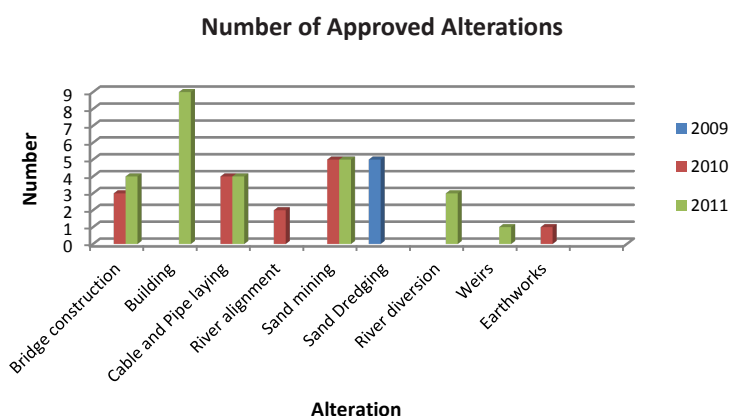
## ALTERATION OF RESOURCES

Resource alterations are any construction or activities that alter or affect existing natural water resources. LUAS licenses resource alteration activities through written approvals. Alteration of resources covers 29 categories of activities that impact rivers such as river diversions and river sand mining.

List of Alteration of Resources			
River diversion	River alignment	Earth works	Sand extraction
Beach reclamation	Land reclamation		
Construction, reconstruction, modification or removal of:			
Dams	Weirs	Inlets or outlets	Log booms
Installation of:			
Pipes	Cables	Sewer pipes	Culverts
Construction of:			
Bridges	Jetties	Hydroelectric plants	Breakwaters
River reserve structures	Intakes	Highways	Fish breeding ponds
Groynes	Walkways	Boat ramps	Boat moorings
Fish racks	Navigation markers	Buildings	

Source: LUAS 2012

All such activities are regulated by LUAS. Approval for any of the activities must be given by LUAS prior to commencement. In the years 2009 to 2011, the activity that LUAS has issued the most approvals was the erection of buildings along the river reserve, most of which consisted of mixed, commercial, residential and industrial development. In 2011, there were 9 approvals for this activity.



Source: LUAS 2012

Jetty licensing and management for inland navigation (outside the port limit) fall under the purview of LUAS. In 2011, a total of 52 written approvals for resource alteration have been issued by LUAS. Along the coast, any jetties inside the port limit will be licensed and managed by the Port Klang Authority.

Along the Sg. Klang river reserve, there are 12 jetties, seven of which are located in Klang Port, two in Kg. Delek, and one each in Sungai Udang Taman Pengkaian Batu, Bagan Hailam, and Bandar Sultan Sulaiman.

Location of jetties	Qty
Port Klang	7
Kg. Delek	2
Sungai Udang	1
Bagan Hailam	1
Bandar Sultan Sulaiman	1

Source: JPBD 2011

Problems arise not with registered jetties, but with those that are built illegally, usually built by the villagers. Most of these jetties are not built to specification and adequate safety standards. Unregulated jetties also make it difficult to assign responsibility for rectification in the case of riverbank failure or severe erosion.

As for river gates, there are 41 along the Sg. Klang river reserve, 19 in the Klang district and 22 in the Shah Alam, Subang Jaya and Petaling Jaya districts. The gates serve to control water flowing into the river from various sources for flood control. Each lock is monitored by an operator appointed by JPS.

Location of gates	Qty
Klang district	19
Shah Alam, Subang Jaya,	22
Petaling districts	N/A

Source: JPBD 2011

### Issues

The building of illegal structures along river reserves is one of the issues that LUAS has been addressing. In a particular case involving illegal dumping in Petaling Jaya, a chute leading to Sg. Klang was constructed so that lorries can dump their load of solid waste directly in the river.



*Illegal chute for dumping garbage from lorries into Sg. Klang*

### Actions Taken

In cases like these, the LUAS Enforcement Team and authorities such as MBPJ, PTD Petaling and JPS Petaling take action to remove illegal structures along the river reserve.

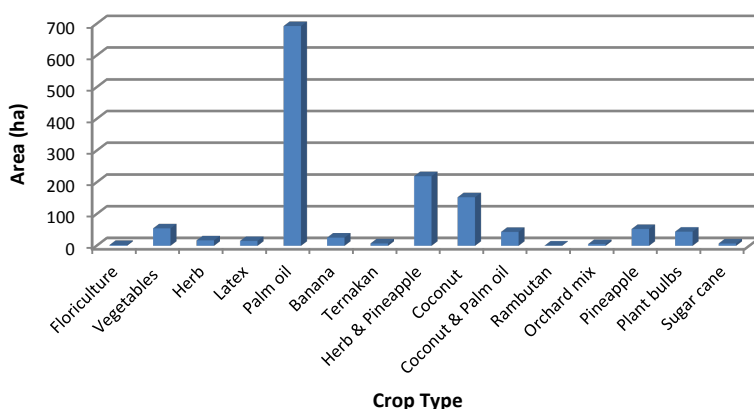
## AGRICULTURAL ACTIVITIES

There are 43,000 registered farmers in Selangor. On average, there is a ratio of one farmer per two hectares of land. In the Sg. Klang basin, palm oil takes the biggest share of the land in the basin at 52% or 693 hectares out of a total 1,343 hectares. This is followed by herbs and pineapples at 16% or 220 hectares and coconut at 11% or 153 hectares.



**DOA** is an agency for encouraging and monitoring agricultural activities

**Major Crops in the River Basin**



Source: Jabatan Pertanian 2012

In central Sg. Klang, banana farms predominate, with 17 such farms along Sg. Klang and its reserves. These farms are usually owned by individual farmers for personal subsistence. The next biggest crops are sugar canes and chilli farms.

### Issues

**Runoff into agricultural land.** One of the issues arising in the basin is runoff from agricultural land. To circumvent such effects, it is recommended to build a holding pond after land clearing, such as at Agrotek at Sungai Batangsi, Hulu Langat. However, there is low awareness of such practices, particularly among the small farm owners. In addition, enforcement by the Jabatan Pertanian (DOA) requires coordination with the land and district offices as land and earthworks falls under these offices.

Conversely, uncontrolled water runoff from development projects into agricultural land poses a problem, particularly in the Sg. Klang and Sg. Langat basin. In many cases, drainage systems within the projects encroach and impact the existing agriculture farms.

**Illegal abstraction of water.** Another issue involves illegal abstraction of water. Small-scale farmers use water piped from inappropriate sources for irrigation, which result in polluted water being used for irrigation.

Ground water abstraction is an option, but it is deemed expensive for some farmers. Water from peat swamps is also used. Peat water is acidic, but in and of itself poses no health or production risk. However, the acidic water has an effect on pesticides in that they become non-biodegradable.

### Actions Taken

The usage of pesticides is regulated and enforced by DOA in terms of quantity and type that can be used. The department collects sample of vegetation, soil and water to check the pesticides level usage by farmer. For some pesticides, a maximum residual level (MRL) test is conducted and if the reading is high, the department advises farmers on the proper usage. For small-time farmers, DOA recommends using vegetation as ground cover (*tanaman tutup bumi*) to avoid pesticides waste flow into the river. Certain types of vegetation such as beans (*kekacang*) have been proven especially effective.

## LIVESTOCK FARMING

There is a variety of livestock husbandry activities in the Sg. Klang basin, with the concentration of livestock land use in the central part of the basin in the Petaling and Subang districts.

In terms of farm count, goat farms are the most numerous, followed by cattle. In 2009, there were 221 goat farms, 173 in 2010, and 193 in 2011. Following goat farms, cattle farms are the next numerous with 160 in 2011. Third in the number of farms are chicken at 49.

	2009		2010		2011	
	Farms	Population	Farms	Population	Farms	Population
Buffalo	7	116	4	84	5	90
Cattle	176	8919	151	5,819	158	6,132
Goat	221	11,596	173	6,544	195	8,335
Sheep	26	1,251	21	613	23	900
Swine	0	0	0	0	0	0
Deer	1	20	2	135	4	135
Horse	4	97	4	94	4	94
Rabbit	4	1,020	2	1,234	2	165

Chicken	48	1,009,310	53	1,023,985	49	1,027,789
Turkey	1	100	1	50	2	66
Quail	0	0	0	0	2	3,400
Duck	9	12,726	5	2,300	8	4,800
Ostrich	1	70	0	0	0	0
<b>TOTAL</b>	<b>498</b>	<b>1,045,225</b>	<b>416</b>	<b>1,040,858</b>	<b>452</b>	<b>1,051,906</b>

*Farms and Population of Livestock in the Sg. Klang Basin*

*Source: JPV 2012*

However, in terms of total population size, chickens outnumber all other livestock. In 2009 the number of chicken stood at 1,009,310; the number rose steadily to 1,023,985 in 2010 and to 1,027,789 in 2011.

### Issues

There have been cases of small-time farmers who set up their livestock facilities on river reserves. Not only are these private facilities on government reserve land, but the proximity of livestock enables wastewater to enter into the waterway. There have been several water treatment plants that have shut down due to effluents from poultry farms. There are guidelines for wastewater discharge from farms, but up to 2011 they were not being fully implemented.



*Chicken coops constructed on the reserves of Sg. Bohol in the Petaling district*

### Actions Taken

The LUAS enforcement team has given notices and taken action against infringers of river reserves. Some of recommendations for future adoption are the introduction of procedures for effluent control for livestock and licensing for discharging wastewater from livestock farming.

In 2011, a programme using Effective Microorganism (EM) technology to improve the water quality was carried out throughout Selangor. EM refers to anaerobic organisms that break down pollutants, and its use is an environmentally friendly approach to cleaning up rivers. The aim of the programme was to address concerns raised by the public.



**JPV** is an agency for animal disease control, inspects livestock farms and processing plants, controls production of livestock, livestock products and animal feed

Jabatan Perkhidmatan Veterinar (JPV) also teaches farmers on how agricultural activities and animal farming can contaminate water bodies and how to manage confined animal facilities. To this end, JPV has published guidelines on Good Animal Husbandry Practices that is being disseminated to farmers.

JPV suggests more stringent enforcement to make sure that good practices and guidelines are being complied. It also promotes the use of Vegetative Filter Strips (VFS). VFS is also known as buffer zones that increase infiltration, slow runoff, and allow more time for sediment, nutrients, and pesticides to settle. They are installed downslope from managed crop or forage areas that have been contain fertilizer, manure, and/or pesticides. The purpose of VFS is to filter and purify runoff as it flows across the filter before discharging into receiving waters.

## AQUACULTURE



**DOF** manages the national fishing industry and delivery system. It issues licensing, approvals and permits to fishing operators.

In the state of Selangor, there are 10,776 aquaculture ponds. The types of ponds are freshwater, brackish water, freshwater cages, brackish water cages, ex-mining ponds, cement tanks, and shellfish. A jetty owned and managed by Jabatan Perikanan (DOF) is used for cockle landings.

For earth ponds, there is a treatment pond whereby water that is released from livestock ponds will be treated before discharge into the rivers. Untreated wastewater results in high BOD levels.

Types of Aquaculture Cultivation	
Freshwater pond	44
Brackish water pond	2
Freshwater cage	0
Brackish water cage	10,495
Ex-mining pond	0
Cement tank	225
Cockle breeding	10
Ornamental fish	0
Mussel breeding	0
<b>Total</b>	<b>10,776</b>

Source: Jabatan Perikanan 2012

It has been observed that aquaculture contributes to the flow of pollutants into the coastal areas of Klang. However, currently there are no agencies to actively monitor wastewater from aquaculture. It depends on the operator to install and operate wastewater treatment on its premises. This is expected to change with the gazetting of the new LUAS regulations on effluent discharge in 2012.



Fish breeding in cages along river  
Source: JPBD 2011

## WET MARKETS/RESTAURANTS/FOOD OUTLETS

There are 66 commercial activities along the Sg. Klang river reserve in the Klang district, which comprises food stalls and restaurants, automotive workshops, shops, and hotels.

Commercial activities	Quantity
Food stalls/ restaurants	13
Workshops	2
Shoplots	50
Hotel	1
<b>Total</b>	<b>66</b>

Source: JPBD Selangor 2011

In Kuala Lumpur alone, there are 97 night markets, 28 wet markets, 44 open markets, and 102 hawker centres.



Trash being disposed outside the allocated bin in Taman Melawati

Most of the foul waste from wet markets ends up in drains and subsequently into the river. The newer markets among Kuala Lumpur's 28 wet markets are connected to public sewers, but the older ones are not.

### Actions Taken

Under the ROL project, DBKL will build wastewater treatment plants at Pasar Pudu, Pasar Sentul, Pasar Chow Kit, and Pasar Borong Selayang, and Pasar Air Panas. Construction works are expected to be completed in 2012.

Construction of the wastewater treatment plants will start in July 2012 for the plants in the Selayang and Old Klang Road markets, with completion due for early 2013. Due to space constraints, DBKL has chosen a membrane bio-reactor which is a compact treatment system. The plant in Selayang market along Jalan Ipoh will sit on a 100 m<sup>2</sup> space.

Designing the plant for the Pudu market, however, will be challenging as there are over 1,000 stalls there are spread all over, and there is hardly any space for a treatment plant. DBKL has received RM3.5 million in 2011 for the plants.

Under Jabatan Kerajaan Tempatan (JKT), communal oil and grease (O&G) traps have been installed in 26 food courts in Kuala Lumpur and 20 each in Ampang Jaya and Selayang.



*O&G trap*  
*Source: Puncak Niaga*

### SQUATTERS

Along Sg. Klang, there were 12 squatter areas within the 50m-reserve corridor along the river. Many of the squatter houses had access to electricity, clean water, and telecommunication. It was observed that the occupants had a practice of throwing refuse directly into the river.



*Houses along the river reserve in Kg. Fajar, Upper Sg. Klang*

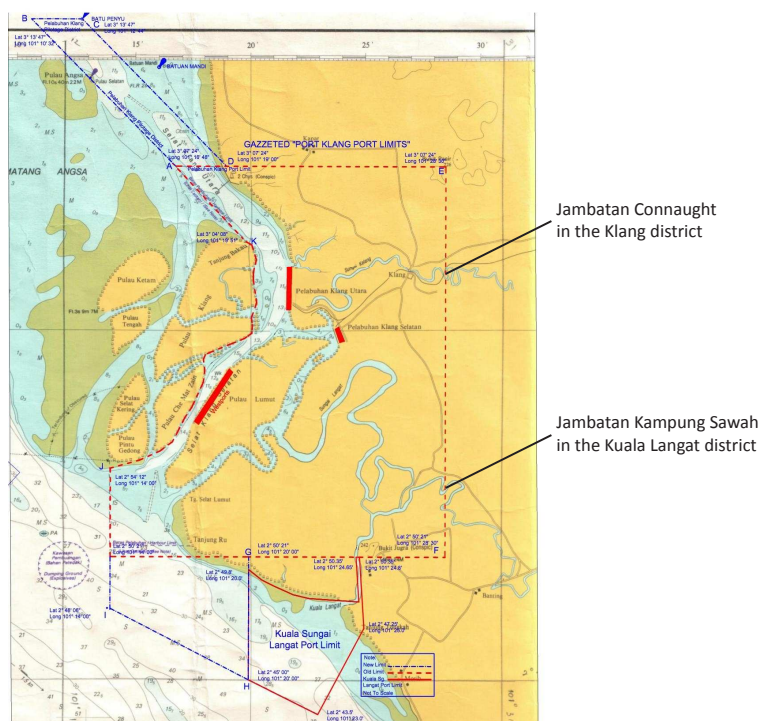
## NAVIGATION



**JLM** is the marine agency that monitors public jetties, ensures navigation safety and regulates maritime activities

There are policies and procedures in navigating the rivers. *Federal Authority Act, Ninth Schedule* stipulates the authority and responsibilities and policies regarding transport and navigation of state rivers. These policies and procedures are to safeguard personal and public safety as well as protect natural water resources. As coastal waters and river waters share common issues, LUAS coordinates with Port Klang Authority and Jabatan Laut Malaysia (JLM).

Along the coast there is an area called the *Port Limit*, which designates the area reserved by the Jabatan Laut Malaysia (JLM) and the Port Klang Authority. The Port Limit covers an area starting from the Kapar Power Station above Sg. Kapar Besar at the north and extends down to the mouth of the Sg. Langat to the south.



*Delineation of port limit*  
Source: LUAS 2011

LUAS's scope falls outside the boundaries of the port limit (demarcated in dotted lines on the map). At the eastern border of the port limit is Jambatan Kampung Sawah. Any river activity east of this point is considered 'inland navigation' while activities west of the point falls under Port Authority or JLM.

However, land activities within the port limit falls under LUAS, and thus all resource alteration activities must procure written approval from LUAS. LUAS' authority extends to water resources 5.5 km or 3 nautical miles offshore, although the international navigation lane is off-limits to LUAS.

The enactment enables LUAS to license and regulate vessels operating in river waters, and as such LUAS oversees the issuance of vessels licenses, collection of navigation fees, coordinates vessel traffic, monitors and conducts vessel checks, and enforces navigation regulations.

Jetty licensing is under Port Klang Authority or JLM; there are no jetties under LUAS in the Sg. Klang basin.



*Port Klang  
Source: JPBD Selangor*

### ***Vessel Activities***

According to Jabatan Perikanan (DOF), the number of fishing vessels registered in Selangor for the Sg. Klang was 1,380 for year 2009 and

1,287 for 2010. The data shows that there was a decrease in the number of vessels from 2009 to 2010.

Fishing zone	Type of vessel	2009	2010
Zon A	No engine	66	51
	Outboard engine	831	754
	Onboard engine	483	429
Zone B	Onboard engine	43	51
Zone C	Onboard engine	1	2
Zone C2	Onboard engine	0	0
Total		1,380	1,287

*Number of Registered Fishing Vessels for Sg. Klang Basin in 2010*

*Source: DOF 2011*

The pattern is also reflected in the number of registered fishermen in Klang, which reduced from a total of 2,033 in 2009 to 1,899 in 2010.

## RECREATION



**Tourism Selangor** is an agency that promotes the state's cultural, historical, artistic and natural attractions and sites

There are ten Selangor State Parks and Amenity Forests in the state. Altogether these parks received 1,624,144 visitors from 2009 to 2011.

In addition to the state parks, there are a number of recreational forests that offer multi-tiered waterfalls, crystalline pools and lush greenery with tropical flora and fauna. In this backdrop, visitors enjoy various activities such as picnicking, trekking, fishing and camping. According to Tourism Selangor, activities such as inner tubing and white water rafting are starting to become popular with fun-lovers and nature goers alike.

Other tourist attractions such as the resorts of the Sepang Gold Coast have distinguished themselves by promoting nature as well as the local culture.

Recreational Sites	Location
Kanching Recreational Forest	Rawang, Gombak
Sungai Tua Recreational Forest	Ulu Yam, Gombak

Bukit Lagong Recreational Forest	Selayang, Gombak
Templer Park	Rawang, Gombak
Commonwealth Forest Park	Selayang
Klang Gates Recreational Area	Gombak
Batu Dam	Gombak
Forest Research Institute of Malaysia	Kepong
Sungai Pisang Waterfall	Karak
Batu Asah Waterfall	Kemensah
Templer Park	Rawang
Tanjung Harapan Recreation	Port Klang

Source: Tourism Selangor



*A family enjoying the waters at Sg. Batu in the Gombak district*

Sungai Batu, a tributary of the Batu Dam, is located in the Sungai Tua Recreational forest and popular destination for weekend getaways. There are some resorts and recreational/picnic areas, and they must be monitored for sewage and solid waste (provision of public toilets and waste bins) to ensure that human activity would not contribute to the pollution of the adjacent rivers. Sources of pollution in the river at the park and recreation sites are visitors who litter plastic bottles and bags as well as Styrofoam food containers at the sites, and the site operators who make improperly designed connections from the individual septic tank to the river, thereby discharging foul water at the health risk of downstream river visitors.

According to Jabatan Kesihatan, one of the ways to address this could be to make it compulsory for recreation sites and resorts to be registered and licensed to operate. This will reduce many cases of outbreaks involving recreation sites with public toilet facilities not built to specification and cause spillage. At the same time, recreational site owners can improve or upgrade water treatment and sanitation at recreational areas so that river water is not contaminated for tourists and river users.

Likewise, LUAS has also initiated the drafting of regulation to control effluents and reduce the negative impact of recreational activities on water resources.

Another river-related recreational site will be not in the forests, but in downtown Kuala Lumpur. One of the key objectives of the ROL is to reconnect the river with the city, and the people with the river. Tourism, retail and commercial sectors are expected to gain a boost, and historical and heritage landmarks such as Jamek Mosque, Little India, and China Town will be showcased to the world.



*Colourful street art adorn Sg. Klang in downtown Kuala Lumpur*



# IMPACT OF POLLUTION

## WATER BORNE DISEASES

River pollution can have negative impact on human health, in the form of water-borne diseases such as cholera and acute gastroenteritis. It also known to cause skin diseases, and constant exposure to heavy metals in the water will give rise to respiratory problems and nervous system failures.

Types of common water-borne diseases are typhoid, leptospirosis, salmonella, and E. coli.

Disease	Effects	Cause
Typhoid	Abdominal pain, diarrhoea, cramps, high fever	Salmonella in contaminated water
Leptospirosis	Flu-like symptoms with stiffness of neck. Can lead to meningitis and liver and kidney disease	Direct contact through animals such as rodents or contact with contaminated water
E. coli infection	Nausea, vomiting, cramps, diarrhoea. Can lead to kidney failure, anaemia and dehydration	E. coli bacteria in wastewater

Source: JKNS 2011

Although the water treatment plants handle pollutants, there are some bacteria that cannot be eradicated by standard water treatment. It has been found that protozoas such as Cryptosporidium and Giardia are

resistant to chlorine, the chemical used to treat pollutants. However, this depends on the treatment process, such as the dose of chlorine, coagulant, media filter and water pH.

Untreated sewage poses a threat to public health since it contains pathogenic bacteria and viruses that cause deadly diseases such as cholera, typhoid, and hepatitis A.



**JKNS** is a government agency that safeguards public health and monitors the environment for factors that impact human health

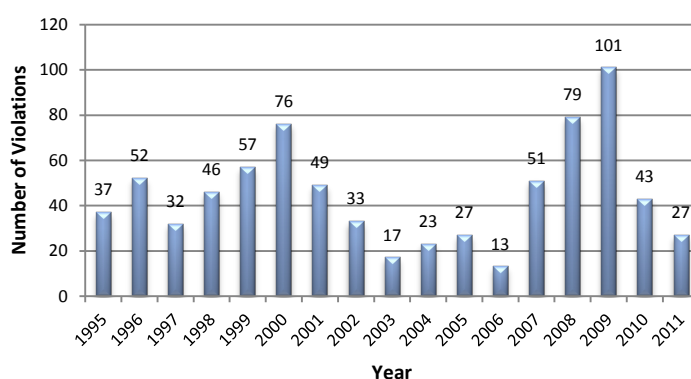
Since 2000, Jabatan Kesihatan Negeri Selangor (JKNS)'s Engineering Services Unit has been conducting Sanitary Surveys, which is routine monitoring of water quality from the water intake to the water treatment plants and up to the reticulation system. The surveys are conducted systematically district by district. If there is a water quality violation, JKNS will conduct investigation together with the treatment plant operator and water supplier. JKNS also conducts an immediate investigation upon receiving a report of the quality of drinking water.

Currently, Engineering Services Unit under the Kementerian Kesihatan is in the process of drafting a bill called the *Safe Drinking Water Act* which is now being tabled in Parliament. This act and the *Water Safety Plan (WSP)* are initiatives to improve the quality of drinking water and subsequently, the quality of human health.

## WATER SUPPLY DISRUPTION

Compared to its neighbouring river basins to the north and the south, the Sg. Klang basin fares better in terms of water supply disruption due to plant shutdowns. However, in 2011 water treatment plants under Puncak Niaga faced with raw water violation due to diesel spillage and a record of high turbidity in the water.

WTP shutdowns within Sg. Klang basin are listed below. Based on historical data since 1997, 16 severe raw water pollution events had led to the shutdown of the affected WTPs, i.e., Gombak WTPs (15 cases) and Ampang Intake WTP (1 case).

**Number of Violations in the Sg. Klang Basin**

Source: Puncak Niaga Sdn. Bhd.

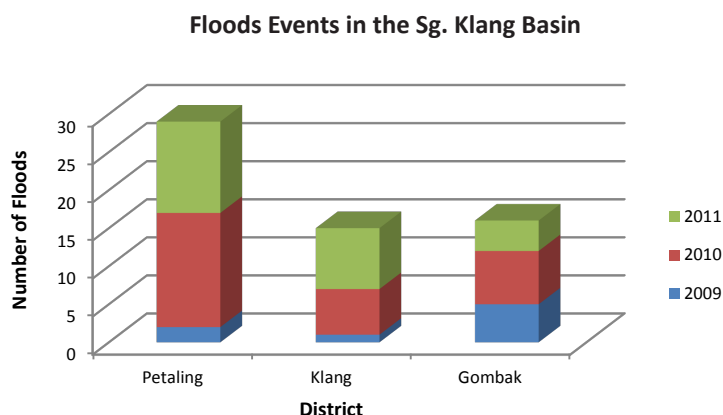
In 2011, one shutdown was recorded at Sg. Gombak WTP after traces of oil was detected at the water intake. However, the source of the pollution was unable to be determined.

In the past, accidental discharge and spillage along the highway has led to the WTP shutdowns caused by severe river pollution due to oil (2 incidents), diesel (7 incidents), and crude palm oil (5 incidents). The causes of the shutdowns are attributed to mostly spillage of diesel and crude palm oil, with one being due to landslide and flood.

## FLOODING

Over the years, flood mitigation works have been carried out to reduce the effects and occurrences of floods. However, according to JPS, flooding problems are no longer limited to rainy seasons and they are increasing from year to year. This could be due to changes in the monsoon winds that bring in the rains twice a year, from October to January and from March to May.

There were 47 flood events from 2009 to 2011 in the Sg. Klang Basin. Districts that were worst hit were Kuala Lumpur in 2010 and 2011 with 7 floods each per year and the district of Petaling with 10 floods in 2010 and 7 in 2011.



Source: *Laporan Banjir Tahunan Negeri Selangor and Wilayah Persekutuan for 2009, 2010 and 2011, JPS*

The causes of flooding were similar across all districts and from year to year, which are:

#### Causes of Flooding

Rapid growth of the construction sector for housing, highways and other major developments

Sedimentation, riverbank erosion and dumping of solid waste into major rivers and streams that hinder smooth river flow

Fast flow of water and increased sedimentation due to rapid development in the basin. A JPS study found that capacity of Sg. Klang is now only able to accommodate 50% of its design capacity due to obstruction from bridges

Inadequate drainage systems that are unable to accommodate large volumes of water

Construction activities on the river reserves

Uncontrolled waste disposal resulting in clogged drains and causing spillovers

Insufficient capacity of the river caused by changes in river sections

Source: *JPS Flood Reports for Selangor 2009, 2010 and 2011*

The list below shows a summary of floods that have occurred over the past three years.

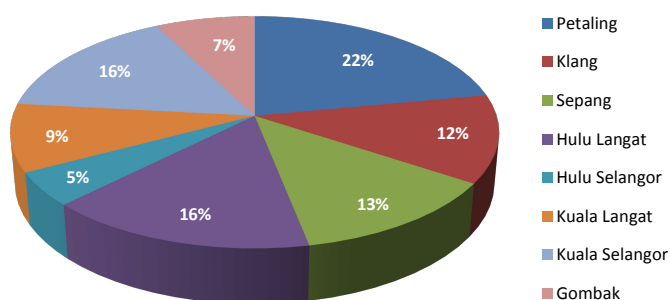
Year	No. of Floods	District	Location
2009	1	Petaling	Jalan Sg. Air Hitam, Kg. Paya Jaras Hilir
	1	Klang	Jalan Batu 3 Lima

	1	Gombak	Kg. Nakhoda, Kg. Laksamana, Kg. Wira Damai, Kg. Melayu Batu Caves, Kg. India
	3	Wilayah	Kg. Pasir Segambut, Jalan Tun Razak, Jalan Kolam Air, Jalan Segambut, Jalan Rahmat, Kg. Kasipillay, Maxwell, PWTC, Jalan Ipoh, Kg. Pasir Segambut, Jalan Chan Sow Lin
2010	10	Petaling	Kg. Melayu Subang, Kg. Subang Ehsan, Kg. Landasan, Taman Subang Perdana, Kg. Subang Perantau; Kg. Seri Aman, Kg. Seri Aman Tambahan, Puchong; Kg. Cempaka; Kg. Seri Aman Tambahan, Kg. Seri Aman Bestari; Taman Mesra, Batu 3, Seksyen U1, Shah Alam; Central Segar; Lebuhraya Persekutuan; Taman Mesra Bt. 3, Lebuhraya Persekutuan; Kg. Melayu Subang; Taman Chi Liung, Persiaran Seraya; Bukit Kemuning, Taman Sri Muda, Jalan Kebun, Bukit Naga
	2	Klang	Taman Chi Liung, Persiaran Seraya, Bukit Kemuning, Taman Sri Muda, Jalan Kebun, Bukit Naga
	2	Gombak	Kg. Laksamana, Selayang Baru, Kg. Melayu, Bulatan Pekan Bt. Arang, Bt. Arang – Tasik Puteri, Bandar Baru Kundang, Kg. Muhibbah Kundang
	7	Wilayah	Jalan Chan Sow Lin, Jalan Batu Bata, Jalan Kuching, Pekan Sg. Besi, Sekolah Maxwell, Lembah Tunku, Jalan Semantan, Jalan Sutan Salahuddin
2011	7	Petaling	Kg. Kebun Bunga, Kg. Bukit Cherakah, Sg. Kenangan, Kg. Paya Jaras Hilir, Kg. Kubu Gajah dan Kg. Merbau Sempak, Bandar Baru Sg. Buloh, Taman Mesra, Batu Tiga, Persiaran Kewajipan, UiTM Shah Alam,
	3	Klang	Bukit Kapar dan Meru, Jalan Sg. Rasa, Taman Sri Muda dan Taman Bukit Rimbau
	3	Gombak	Pekan Baru Kundang, Kg. Bunga Raya, Kg. Melayu Sg. Buloh
	7	Wilayah	Kg. Pindah, Kg. Baru, Jalan Semarak, Jalan Tun Razak, Jalan Ampang; Jalan Chan Sow Lin; Jalan Gurney; Jalan Pudu, Jalan Raja Chulan, Jalan Sultan Ismail

Source: JPS Selangor 2011

Within the three river basins for Sg. Klang, Sg. Selangor and Sg. Langat, 55 major areas outside of Kuala Lumpur were afflicted with floods in 2009. The most widespread was in Sepang with 24 flood-stricken areas and Hulu Langat 12. The budget for flood mitigation in 2009 was RM36,780,200. The district of Petaling received the biggest portion of the budget (22%), followed by Kuala Selangor (16%) and Hulu Langat (16%).

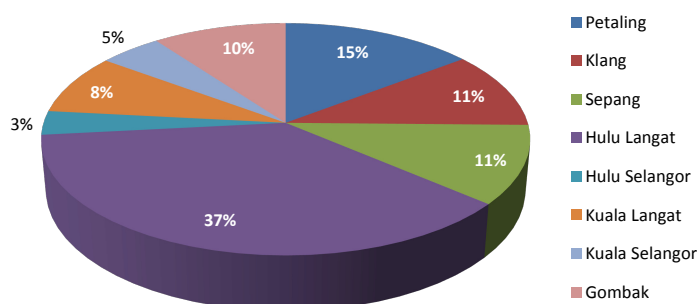
### Budget Apportionment for Flood Mitigation Works 2009



Source: Laporan Banjir Tahunan Negeri Selangor for 2009, JPS

In 2010, 44 major areas were hit with floods. Areas within the Petaling district had the highest number of floods at 15 and Sepang with 10. In terms of flood mitigation works, the budget shrank from the previous year to RM15,386,420. The district of Hulu Langat received the biggest portion (37%), in response to the massive flooding in the previous year. This is followed by Petaling (15%) and Klang and Sepang (both at 11%).

### Budget Apportionment for Flood Mitigation Works 2010

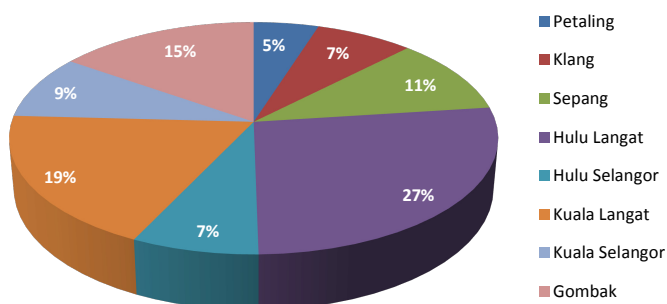


Source: Laporan Banjir Tahunan Negeri Selangor for 2010

In 2011, the number of major areas affected by floods jumped to 70. Areas with the highest flood impact were in the Petaling district (12), Hulu Langat (13), and Kuala Langat (12). Conversely, the flood mitigation works budget had shrunk to RM10,048,482. The districts with

the most works were Hulu Langat (27%), Kuala Langat (19%) and Gombak (15%).

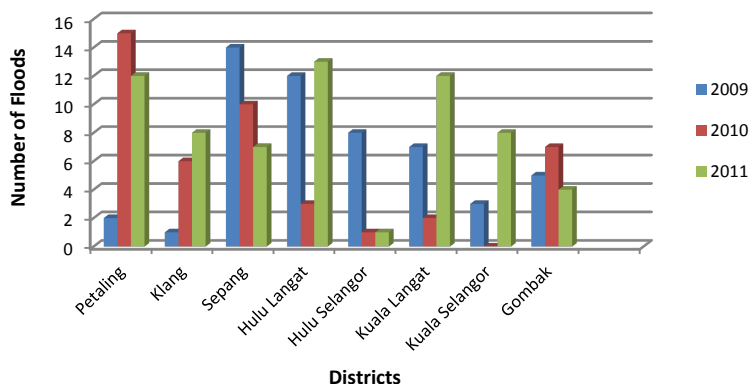
### Budget Apportionment for Flood Mitigation Works 2011



Source: *Laporan Banjir Tahunan Negeri Selangor for 2011*

The graph below shows districts that are the most hit with floods over the past 3 years.

### Areas Most Hit by Floods



Source: *Laporan Banjir Tahunan Negeri Selangor for 2011*

As mentioned earlier, the causes of the floods are due to increased development in the urban areas, while insufficient drainage systems and unusually heavy rainfall are attributed to areas outside the city centre.

### Actions Taken

In 2008, DBKL officially endorsed the application of MSMA to be adopted for all new development in Kuala Lumpur. MSMA is short for *Manual Saliran Mesra Alam*, or *National Stormwater Management Manual*, which provides detailed instructions for designing structures for controlling urban stormwater.

One of the key initiatives will be the implementation of the Drainage and Stormwater Management Plan by DBKL. The lead agency is JPS, which is tasked to improve and upgrade drainage systems in Kuala Lumpur that are below the required capacity. This is being done in areas along the Gombak, Klang, Batu, and Kerayong rivers. A total of ten packages are being implemented, with seven already at various points of construction stage. The entire works is due for completion in 2013.



*River rehabilitation being carried out*



### Indicator 7: Impact – Number of Flood Incidents

In 2009, there were 20 areas within the districts of Klang, Petaling and Gombak and Wilayah Persekutuan that were stricken by flooding in the Sg. Klang basin, while in 2010 there were 38 areas and in 2011, 39 areas. The number of areas affected by floods has increased from 2009 to 2011. Despite the increase in flooding in the stricken areas, the budget amount spent on flood mitigation works continued to decrease.



Source: Laporan Banjir IPS Selangor 2009, 2010 and 2011

## COMMERCIAL FISHING



DOF is an agency that regulates fishery and aquaculture activities through vessel licensing and fishing and transport licensing

The commercial fishing industry for Selangor yielded 383,433 metric tonnes during the years 2009 to 2011, valued at RM471.56 million. The Fish Landing Declaration Report for Port Klang, which is based on catch declaration by registered fishermen, cites over RM1 million in catch value. Within the Sg. Klang river basin alone, fish landings have been growing steadily at 11,303 metric tonnes in 2009; 23,062 metric tonnes in 2010; and 26,826 metric tonnes in 2011. Altogether this represents a fish yield of 61,193 metric tonnes within the basin.

Below are some of the fish species that have been caught in Sg. Klang:

Fish Species in Selangor Rivers			
Bawal hitam	Bawal putih	Belanak	Bilis nangka
Bulan-bulan	Cermin	Cincaru	Daun baharu
Demudok	Duri	Gelama	Gerut-gerut
Jenahak	Kerapu	Ketam batu	Kurau
Lidah	Lumi-lumi	Lundu	Malong
Parang parang	Pelata	Puyu laut	Sebelah
Selar	Semilang	Senangin	Siakap

Sotong biasa	Sotong katak	Talang	Tenggeri
Udang harimau	Udang kuning	Udang minyak	Yu

Source: DOF 2012



*Ikan Aji-Aji*

Source: LKIM



*Ikan Kerapu*

### Actions Taken

According to Jabatan Perikanan Selangor (DOF), most of the species listed above have reduced in population. This is confirmed by the Malaysia Fisheries Development Board (LKIM), who says that one of their concerns is that the over the past years, the volume of fish landing is not increasing.



**LKIM** is an agency that provides assistance to local fishermen through financial incentives, skills development and technology improvement

To overcome this, the Resources Management Unit under DOF has rolled out an initiative to release specific fish species in certain river areas. However, the releases have been done in other river basins and none in the Sg. Klang area.

In terms of fishing licenses issued, DOF has not been issuing any inland fishing licenses because at this point in time, the River Fishing Act has not yet been enforced in Selangor. Once enforced, the penalty for illegal fishing will be RM20,000 or jail sentence of not more than two years, or both.

## COASTAL WATERS

The quality of coastal waters of Klang and Kuala Langat is declining due to the increased dumping of wastes into upstream catchment activities, especially from housing and industrial areas, as well as discharges from agricultural and urban areas. Especially affected is the district of Klang, which comprises Mukim Klang (including the islands in the waters of Klang) and Mukim Meru.

These two mukims are located in the coastal areas of Klang. As a downstream district, the coastal areas of Klang bear the full force of all impacts from activities and developments carried out in the upstream catchments of two major rivers, namely Sg. Klang and Sg. Langat. Both rivers are seriously polluted by sewage discharges, industrial wastewaters and land runoff, which are not properly treated. Sg. Klang flows across many districts and local authorities in the Klang Valley including Kuala Lumpur.

In addition to the upstream sources, there are also direct discharges of surface runoff, domestic sewage, ship wastes and industrial discharges into coastal waters. River and coastal waters are contaminated by *E. coli* in excess of marine water quality standards. Other contaminants, such as inorganic chemicals, are also present, which will not only threaten the ecosystem, but also enter the food chain resulting in human health risks.

Port Klang is the premier port of Malaysia, with more than 14,207 vessel arrivals in 2001. The port does not have reception facilities for wastes from ships which exposes it to potential threat of oil spills from port operations.

In addition to this, discharges from ships in transit through the Straits of Melaka, or shipping accidents in the port or in the Straits, are a constant threat to the coastal waters and resources of the area.

LKIM also reports that pollution at the river mouths and within the river affects the fish and other catch population. Sensitive species such as udang galah, an indigenous crawfish, need freshwater to flourish, but the presence of pollution threatens its survival. Inert solid waste in the form of tree stumps, branches, and tree cuttings have also been found floating in quantities along the river.

#### *Actions Taken*

LUAS, through the Port Klang Coastal Strategy Implementation Plan, actively encourages waste minimisation, recycling and reuse, the development of best practices for the handling and disposal facilities and technologies, and the minimisation of the impact of dumping and illegal disposal.

# PUBLIC AWARENESS AND PARTICIPATION

Preservation and protection of water resources requires the efforts of the government, the private sector, civil societies and the general public. Thus, programmes involving the public play an important part in ensuring that communities become aware of the environmental changes around them and take action to make sure that natural resources are protected for future generations to enjoy.

To this end, there are several awareness and participation programmes that have been initiated in the areas of river protection.

**RIVER CARE** Since 2008 LUAS' **QUA QUA** programme has been working with students, teachers, NGOs, public and private sectors, and the general public in monitoring the quality of river water within their communities. It aims to educate participants on methods of detecting river pollution sources and creating awareness of the importance of caring, protecting and appreciating rivers as the main source of water supply. Carried out in Sg. Gombak in the Klang river basin, the Qua-Qua Programme uses three methods—physical observation, chemical testing and use of biological indicators—to analyse and monitor the quality of water sources and rivers.



*Award presentation in a Qua Qua programme with schoolchildren*



*Qua Qua Programme with school children*

Another programme, called River Ranger, is run by JPS and aims to improve the water quality of rivers in various states. In Selangor, the river that was selected under the programme was Sg. Pencala. Involving the participation of government agencies, NGOs, private sectors and the general public, stakeholders learned to develop and engage in river auditing and conservation projects on rivers within their communities.

**MANGROVE PLANTING** LUAS has carried out mangrove planting programmes along Sg. Klang at Teluk Gong and Bagan Hailam. The programmes were carried with local authorities and Jabatan Perhutanan to plant approximately 1,000 saplings at each site. The saplings help preserve the natural buffer against tidal waves and strong winds as well as reduce erosion of the shoreline.

**RIVER CLEANING** This programme is run under Projek Pembangunan dan Pemuliharaan Sungai Klang. Two programmes have been carried out at Sg. Gombak and Sg. Klang to raise awareness on the importance of clean water supply and on the public's responsibility in ensuring that rivers are cleared of trash through community service programmes.



*CSR Programme for mangrove planting*



*LUAS with Total Logistics Services (M) Sdn. Bhd.*

**COASTAL CLEANING** A total of 11 beach cleanup programmes were carried out, out of which two were done at Tanjung Harapan Beach and Bagan Hailam Beach. This programme is important as many of the beaches are popular tourist sites.

**COOKING OIL RECYCLING** The Water Resources Conservation Programme through Cooking Oil Recycling encourages the public to recycle used cooking oil by selling it to recognised LUAS corporate partners that will convert it into biodiesel. This programme, which is run at schools and communities, has several benefits as it promotes environmentally friendly alternative energy sources, brings income to the communities and controls the source of pollution which is oil, a substance that sewage treatment plants often find difficult to process.

There were other public awareness programmes conducted by agencies during the years 2009 to 2011.



*Coastal Cleaning*



*Cooking Oil Recycling Programme*

**Jabatan Perhutanan** carries out programmes for school children at the Sg Tekala Amenity Forest every year, in collaboration with TrEES, JPS and also LUAS.

**JAS Selangor** carried out briefings and talks to industry groups, schoolchildren, universities, local authorities and the general public. Programmes included activities at Paya Indah Wetlands for ecosystem protection and school camps in Ulu Klang to promote forest and river ecosystem awareness.

## APPENDIX A. WATER QUALITY INDEX

Since 2001, JAS has been conducting water quality monitoring programme to detect changes in river water quality and to identify pollution sources. JAS collects water samples at regular intervals from designated stations to determine physic-chemical and biological characteristics.

The WQI serves as a basis for environmental assessment, whereby categorisation and designation of classes according to beneficial usage as stipulated in the National Water Quality Standards for Malaysia (NWQS).

The WQI is calculated based on six parameters, which are dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammoniacal nitrogen, total suspended solids (TSS), and pH.

WQI Class	Range	Water Usage Description
I	<92.7	Conservation of natural environment
		Water supply I – practically no treatment needed (except disinfection or boiling only)
		Fishery I – very sensitive aquatic species
II	76.5 – 92.7	Water supply II – conventional treatment required
		Fishery II – sensitive aquatic species
		Recreational use with body contact
III	51.9-76.5	Water supply III – extensive treatment required
		Fishery III – common, of economic value and tolerant species
IV	31.0-51.9	Irrigation only
V	<31.0	Water unsuitable for any of the above uses

Source: JAS 2011

## APPENDIX B. EFFLUENT STANDARD

Until 2008, effluent discharges were stipulated under the Environmental Quality Act 1974 and the Environmental Quality (Sewage and Industrial Effluent) Regulations 1979.

In 2009, revisions were introduced by Kementerian Sumber Asli dan Alam Sekitar, resulting in two sets of regulations—the Environmental Quality (Sewage) Regulations 2009 (EQSR) and the Environmental Quality (Industrial Effluent) Regulations 2009.

Standard	Temp (C)	pH	BOD	COD	SS	NH <sub>3</sub> -N	NO <sub>3</sub> -N	P	O&G
<b>Category 1 (Rivers)</b>									
Standard A	40	6.0-9.0	20	120	50	10	20	5	5
Standard B	40	5.5-9.0	50	200	100	20	50	10	10
<b>Category 1 (Lakes)</b>									
Standard A	40	6.0-9.0	20	120	50	5	10	5	5
Standard B	40	5.5-9.0	50	200	100	5	10	10	10
<b>Category 2</b>									
Standard A	n/a	n/a	20	120	50	50	n/a	n/a	20
Standard B	n/a	n/a	50	200	100	50	n/a	n/a	20
<b>Category 3</b>									
CST (STD A & B)	n/a	n/a	200	n/a	180	n/a	n/a	n/a	n/a
IT (STD A & B)	n/a	n/a	175	n/a	150	100	n/a	n/a	n/a
OP (STD A & B)	n/a	n/a	120	360	150	70	n/a	n/a	n/a
AL (STD A & B)	n/a	n/a	100	300	120	80	n/a	n/a	n/a
MP (STD A)	n/a	n/a	60	180	100	60	n/a	n/a	20
MP (STD B)	n/a	n/a	60	240	120	60	n/a	n/a	20

*Schedule of EQA 1974 (Sewage and Industrial Effluent), Revision as of December 2009*

*Source: IWK 2012*

## APPENDIX C. POTENTIAL SOURCES OF RAW WATER POLLUTION

Shows the categories of pollution found in river water and how they are measured. Possible sources of pollution are listed.

Group	Parameter	General Potential Sources
Microbiological	Total Coliform	Sewage effluent – residential and livestock farming
Physical	Turbidity	Earthworks, sand mining, heavy rainfall
	Color	Industrial effluent, mining pools, swamps
	pH	Industrial effluents, swamps
Inorganic	BODs	Agriculture, natural vegetation, leachate, waste disposal, livestock farming, industrial effluents, earthworks, swamps
	COD	Agriculture, natural vegetation, leachate, waste disposal, livestock farming, industrial effluents, earthworks, swamps
	Ammonia	Domestic waste, industrial effluent, leachate, sewage effluent
	Total nitrogen	Agriculture, natural vegetation
Iron & Manganese	Industrial effluent, earthworks	
Heavy Metals		Industrial effluent, earthworks
Pesticides		Agriculture, recreation

Source: SYABAS EIS 2011

## APPENDIX D. LIST OF PARAMETERS AND LIMITS OF DISCHARGE

Shows activities, related parameters and limit of discharge to be inspected and monitored by LUAS.

Activity	Parameter	Limit for Discharge
<b>Freshwater aquaculture in ponds or cages</b>	Ammoniacal Nitrogen (NH <sub>3</sub> -N)	5 mg/l
	Biochemical Oxygen Demand (BOD <sub>5</sub> ) at 20oC	50 mg/l
	Total Suspended Solid (TSS)	100 mg/l
	Nitrogen Nitrogen (TN)	10 mg/l
	Phosphorus (TP)	1 mg/l
<b>Marine shrimp aquaculture in ponds</b>	Ammoniacal Nitrogen (NH <sub>3</sub> -N)	5 mg/l
	Biochemical Oxygen Demand (BOD <sub>5</sub> ) at 20oC	50 mg/l
	Total Suspended Solid (TSS)	100 mg/l
	Nitrogen Nitrogen (TN)	10 mg/l
	Phosphorus (TP)	1 mg/l
<b>Development and earthworks</b>	Total Suspended Solid (TSS)	100 mg/l
	Oil and grease	10 mg/l
<b>Livestock other than pigs</b>	Ammoniacal Nitrogen (NH <sub>3</sub> -N)	200 mg/l
	Biochemical Oxygen Demand (BOD <sub>5</sub> ) at 20oC	200 mg/l
	Chemical Oxygen Demand (COD)	500 mg/l
	Total Suspended Solid (TSS)	500 mg/l
<b>Swine livestock</b>	Ammoniacal Nitrogen (NH <sub>3</sub> -N)	200 mg/l
	Biochemical Oxygen Demand (BOD <sub>5</sub> ) at 20oC	50 mg/l
	Chemical Oxygen Demand (COD)	500 mg/l
	Total Suspended Solid (TSS)	100 mg/l
<b>Pets</b>	Ammoniacal Nitrogen (NH <sub>3</sub> -N)	300 mg/l
	Biochemical Oxygen Demand (BOD <sub>5</sub> ) at 20oC	50 mg/l
	Chemical Oxygen Demand (COD)	500 mg/l
	Total Suspended Solid (TSS)	250 mg/l
<b>Mining-related activities</b>	Total Suspended Solid (TSS)	50 mg/l
	Oil and grease	1 mg/l

Source: LUAS 2012

## APPENDIX E. CONTRIBUTORS

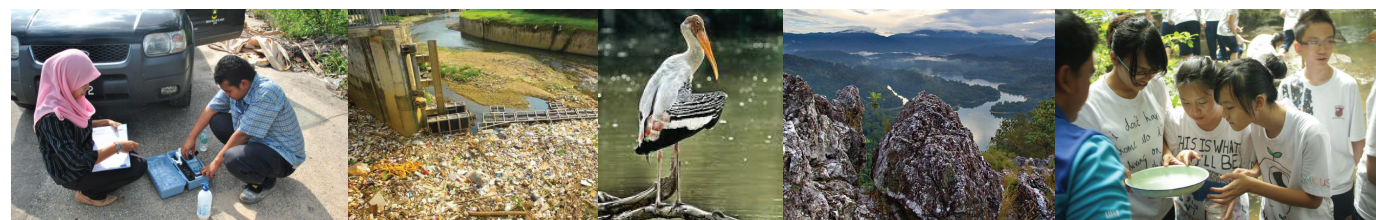
State government and private agencies have generously contributed their time, effort, and thoughts towards making this booklet as resourceful as possible. In this way, LUAS is the enabler of the dissemination of information provided by the agencies for the use of all people interested in preserving and caring for our precious water resources. We extend our gratitude to these contributors.

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 Jabatan Perancangan Bandar dan Desa Selangor  
 Jabatan Kesihatan Negeri Selangor  
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 Majlis Bandaraya Shah Alam

Majlis Perbandaran Klang  
 Majlis Daerah Hulu Selangor  
 Majlis Daerah Kuala Selangor  
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ISSN 2180-2807



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