SUNGAI LANGAT

State of the River Report 2011

LEMBAGA URUS
AIR SELANGOR (LUAS)

Sg. Langat was named after the town located at the river's estuary. 'Langat' is derived from the Minangkabau word that means 'air hangat' or lukewarm water. The name was given by traders who found that the river water near the estuary was always warm. Other sources say that the presence of the Selangat fish that was often caught by fishermen gave rise to the name.

The cover picture was taken at Jugra Hill overlooking Sg. Langat in the district of Kuala Langat, a favourite spot for paragliders who enjoy the view as well as the thrill of flying. In the background is the mouth of the river, where barges carrying payloads of steel and other essentials go up and down the river to destinations within the basin.

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ACRONYMS

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

LKIM	Lembaga Kemajuan Ikan Malaysia/*Malaysian Fisheries Development Authority*
LLM	Lembaga Lebuhraya Malaysia/*Malaysian Highway Authority*
LUAS	Lembaga Urus Air Selangor/*Selangor Water Management Authority*
MCM	Million cubic metre
MDKL	Majlis Daerah Kuala Langat/*Kuala Langat District Council*
MDKS	Majlis Daerah Kuala Selangor/*Kuala Selangor District Council*
MLD	Million litres per day
MNS	Malaysia Nature Society
NAHRIM	National Hydraulic Research Institute Malaysia
NH_3–N	Ammoniacal nitrogen
PDTHL	Pejabat Daerah dan Tanah Hulu Langat/*Hulu Langat Land and District Office*
PERHILITAN	Jabatan Perlindungan Hidupan Liar dan Taman Negara/*Department of Wildlife and National Parks*
PKA	Port Klang Authority
PNSB	Puncak Niaga Sdn. Bhd.
PPj	Perbadanan Putrajaya/*Putrajaya Corporation*
ROL	River of Life
SPAN	Suruhanjaya Perkhidmatan Air Negara/*National Water Services Commision*
SPLASH	Syarikat Pengeluar Air Sungai Selangor Sdn. Bhd.
SS	Suspended solids
STATS	Jabatan Perangkaan/*Department of Statistics*
STP	Sewage treatment plant
SYABAS	Syarikat Bekalan Air Selangor
TSS	Total suspended solids
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. Langat 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.

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

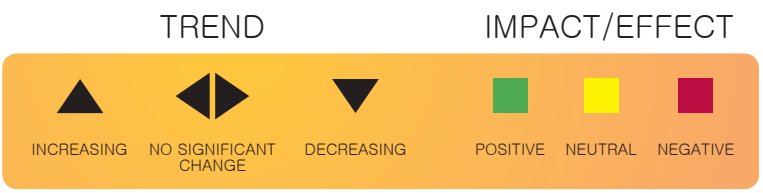
dissemination of information provided by the agencies for the use of all people interested in preserving and caring for our precious water resources. We extend our gratitude to these contributors, whose names are listed in Appendix E.

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 color 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. Langat basin is the second largest river basin among the seven in Selangor with a length of approximately 200 km and an area of 2,423 km². It extends into two states, with 76% of the river basin in Selangor and 20% in Negeri Sembilan. A smaller portion of the basin, about 4%, covers part of the Federal Territory of Putrajaya and the Klang and Petaling Jaya districts. The river basin originates from the Titiwangsa Range in Gunung Nuang before draining into the Straits of Melaka.

Sg. Langat basin

Tributaries

The main tributaries of the Sg. Langat basin are Sg. Semenyih, Sg. Beranang and Sg. Labu. There are 40 other smaller tributaries.

Some tributaries of the Sg. Langat basin			
Sg. Mersing	Sg. Pangsoon	Sg. Congkak	Sg. Batang Nilai
Sg. Lui	Sg. Ramal	Sg. Lenggeng	Sg. Pajam
Sg. Gabai	Sg. Tekala	Sg. Gemi	Sg. Saring
Sg. Batangai	Sg. Rinching	Sg. Chuau	Sg. Jenderam
Sg. Chincang	Sg. Banting	Sg. Keluang	Sg. Deman
Sg. Dua	Sg. Semungkis		

Source: Sungai Langat Integrated River Basin Management Study 2005

Major Towns and Administrative Bodies

The basin has seven city councils and district offices. The major towns and cities are Bangi, Kajang, Sepang, Dengkil, Hulu Langat, Cheras, Nilai, Banting, Putrajaya and Semenyih.

State	District
Selangor	Majlis Perbandaran Klang
	Majlis Perbandaran Kuala Langat
	Majlis Daerah Hulu Langat
	Majlis Perbandaran Sepang
Negeri Sembilan	Majlis Perbandaran Nilai
Federal Territory of Putrajaya including Cyberjaya	Perbandaran Putrajaya, Cyberjaya
Federal Territory of Kuala Lumpur	Dewan Bandaraya Kuala Lumpur

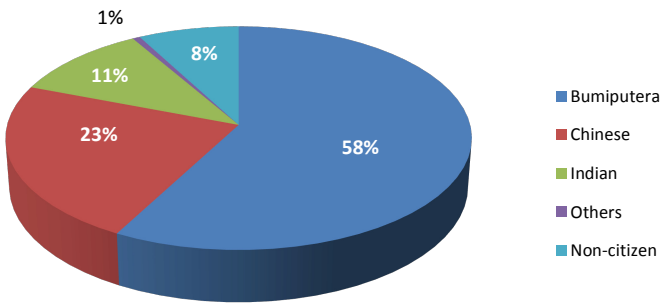
Source: LUAS 2012

Jabatan Perangkaan MALAYSIA

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

Population

The population of the Sg. Langat basin is approximately 1,380,978 according to Jabatan Perangkaan Selangor. The basin is populated by Bumiputera at 58%, followed closely by Chinese at 23%. Indians occupy 11%, other races 1% and non-citizens almost 8 %.



Population and breakdown of the Sg. Langat Basin
Source: Jabatan Perangkaan Selangor 2012

MAIN USES OF THE RIVER

The Sg. Langat basin has undergone widespread development involving many activities such as urban and industrial land development, agriculture, sand abstraction, quarrying and navigation. The river provides important natural resources to support economic activities in the state. One of the resources is water: the river supplies about 1,000 million litres per day (MLD) of potable water, which is about 30% of the total supply requirement of Kuala Lumpur and Selangor.

Another important activity is sand mining. Large tracts of sand exist in tin mine tailings and along certain river stretches. Categorised as 'industrial sand', it is used for road construction to meet the needs of the growing construction industry. Further downstream, the river is used by barges to transport scrap iron. Other uses of the river include recreation, fishing and irrigation.

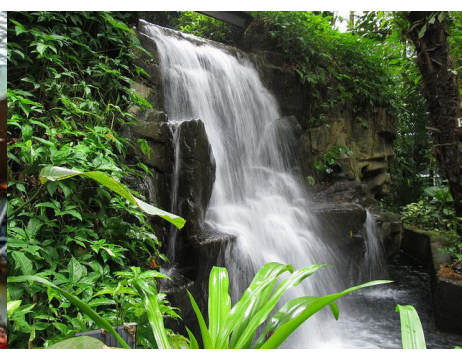
While these activities bring economic benefits to the state, the way in which they have been carried out has negative impact on the environment as well as human health. The rivers of the Sg. Langat basin are showing signs of stress under these impacts, as indicated by sedimentation of rivers, deterioration of water quality from industrial and domestic pollution, degradation of riparian zones, depletion in biodiversity, increase in frequency and severity of floods, stream bank erosion and loss of buffer zones against pollution.

In turn, these conditions affect people through higher incidence of water-borne diseases, reduction in the recreational use of water, disruption of economic activities and water supply shortages.

Chalets at Sg. Langat near Kg. Sg. Congkak, Hulu Langat

DISTINCTIVE FEATURES OF THE BASIN

The Sg. Langat basin showcases natural and manmade features that add uniqueness to the basin. The **Kuala Lumpur International Airport** is Malaysia's main international airport and is also one of the major airports of South East Asia. It is about 50 km from Kuala Lumpur, in the Sepang district of southern Selangor state. Ranked as the 5th busiest international airport in Asia, the main terminal building area features a 'Rainforest in the Airport' whereby an entire section of rain forest was transplanted from the jungle into the airport.



Kuala Lumpur International Airport
Source: Flickr rpiker101.com and foongpc_com.jpg

Not far from KLIA is **Putrajaya**, which is the administrative centre for the Federal Government whose grand and soaring architecture epitomizes

the vision of a modern Malaysia with the latest infrastructure and modern facilities.

View of Putrajaya Lake
Source: www.skyscraper.com and www.sleeplessinKL.com

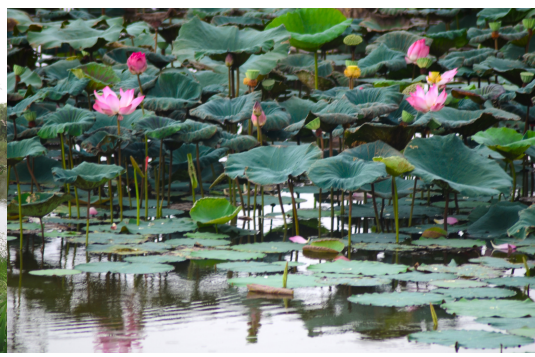
Next to Putrajaya is the Silicon Valley of Malaysia, **Cyberjaya**, a town with a science park as the core that forms a key part of the Multimedia Super Corridor in Malaysia. It is located in the district of Sepang, Selangor and is situated about 50 km south of Kuala Lumpur.

Buildings in Cyberjaya
Source: www.limkokwing.net; www.mmu.edu.my on BeritaHarianOnline

One of the defining water features of Putrajaya is the 400-hectare **Putrajaya Lake** that was designed to enhance of aesthetic appeal of the federal administrative capital. The lake was created by inundating the valleys of Sg. Chuau and Sg. Bisa. It is offers a cool venue for sports and recreational activities as well as serving as a tourist attraction.

Source: Perbadanan Putrajaya

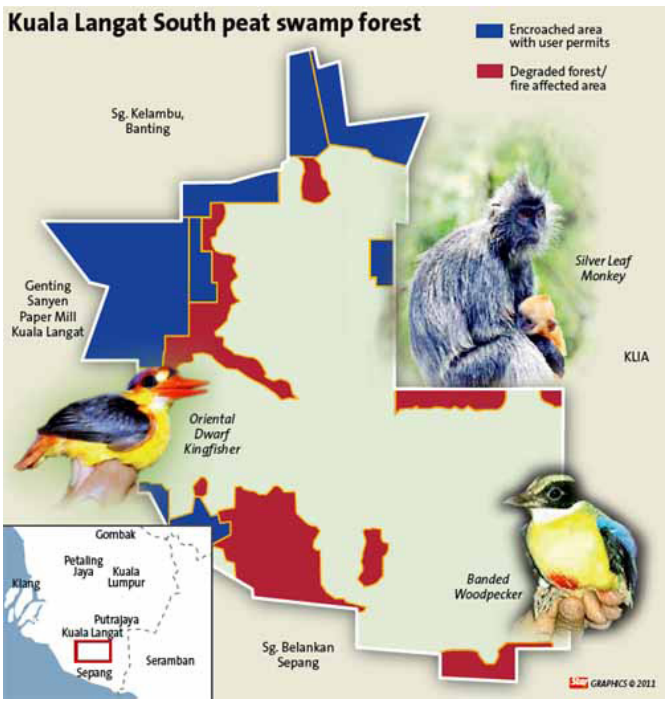
Protecting Putrajaya Lake by acting as a natural filter, **Putrajaya Wetlands** have been planted with a variety of aquatic plants to remove nutrients and pollutants from the upstream Sg. Chuau river basin. In addition to being a water cleansing and filtration system, the wetlands also serves in flood mitigation, nature conservation, ecotourism, recreation, research and education and protection against soil erosion.



Taman Wetland, Putrajaya

Peat swamp forests store carbon, support biodiversity, regulate water, and have the ability to store carbon through sequestration. The **South Langat Peat Swamp Forest** consists of virgin jungle reserve combined with degraded and regenerating trees. Not only does this forest have

high value timber species such as *Koompasia malaccensis*, *Shorea teysmanniana*, *Tetramerista glabra* and *Gonystylus bancanus*, they are also valuable as sites for potential forest carbon sinks.



Source: The Star 2011

SIGNIFICANT RIVER WORKS

Significant works done within the Sg. Langat basin involved flood prevention and mitigation, riverbank improvement, and works under the River of Life (ROL).

Significant River Works	
2010	Flood mitigation works on Sg. Bangi, Mukim Kajang, Hulu Langat district
	Flood prevention works on Sg. Sekamat, Mukim Cheras, Hulu Langat district
	Flood prevention works on Sg. Sekamat, Mukim Cheras, Hulu Langat district
	River improvement on riverbank of Sg. Balak, Mukim Kajang, Hulu Langat district

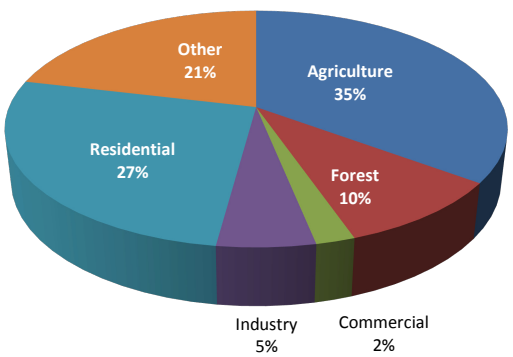
2011	Flood mitigation works on Sg. Seputeh (Phase 1) at Kg. Tasek Permai, Mukim Ampang, Hulu Langat district
	Flood prevention works on Sg. Seputeh at Kg. Tasek Wangsa Keringat (Phase 2), Mukim Ampang, Hulu Langat district
	River improvement works on Sg. Sering, Mukim Cheras, Hulu Langat district
	Supply and installation of gross pollutant traps (GPTs) and related works in the Sg. Klang river basin in the Gombak and Hulu Langat districts for the Project River of Life (ROL) Intiative 4
	Installation of automated Trash Rakes and related works in the Sg. Klang river basin in the Gombak and Hulu Langat districts for the Project River of Life (ROL) Intiative 4

Source: JPS Selangor 2011

LAND USE

The Sg. Langat basin is one of the fastest growing economic areas in Malaysia. Currently, the river basin has vast tracts of forested areas that serve as habitat to wildlife. It features a collection of forest reserves such as those in Sg. Lalang, Hulu Langat, Hulu Semenyih and Sg. Jeluh. These forests feature many relatively pristine and scenic sites that make the upper sections well-known for recreation and ecotourism. Elsewhere, agricultural use of the land dominates the basin. The land use in the upper section of the basin in Majlis Perbandaran Kajang shows high percentage of agricultural and residential use.

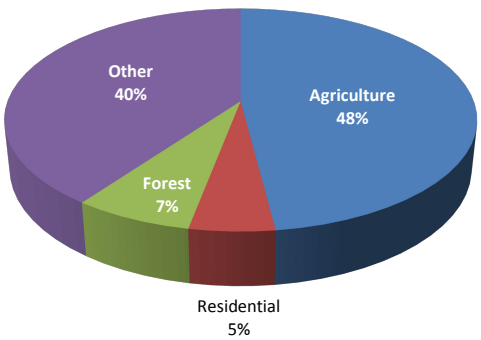
Upper Basin Area - Majlis Perbandaran Kajang



Source: JPBD Selangor 2011

The middle section of the basin in the Majlis Perbandaran Sepang shows increasing use of agricultural land.

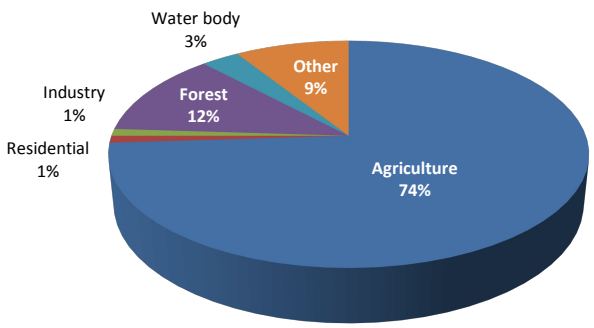
Middle Basin Area - Majlis Perbandaran Sepang



Source: JPBD Selangor 2011

Further downstream towards the river mouth within the Majlis Daerah Kuala Langat, the distribution of land use shows that it is predominantly agricultural.

Lower Basin Area - Majlis Daerah Kuala Langt



Source: JPBD Selangor 2011

SUNGAI LANGAT RIVER BASIN

LEGEND

- STATE BORDER
- RIVER
- DUMPING SITE
- SAND MINING
- QUARRY
- INDUSTRY
- LANDFILL
- LAND CLEARING
- JETTY
- SEWAGE TREATMENT PLANTS
- LIVESTOCK FARMING
- RESIDENTIAL
- BUSINESS PREMISES
- RECREATIONAL AREA
- PALM OIL PLANTATION

WATER INTAKE POINTS

1. SG. PANGSOON WTP
2. SG. LOLO WTP
3. SG. SERAI WTP
4. SG. LANGAT WTP
5. CHERAS MILE 11 WTP
6. BUKIT TAMPOI WTP
7. SALAK TINGGI WTP

Source: SYABAS EIS 2011 and LUAS


WATER QUALITY
CLEAN
SLIGHTLY POLLUTED
POLLUTED
Sg. Langat Dam
HULU LANGAT
Sg.Lui
Sg.Langat
HULU LANGAT
Sg. Semenyih Dam
HULU LANGAT
CHERAS
HULU SEMENYIH
Pekan Sungai Chua
KAJANG
Sg.Ramal
Bandar Baru Bangi
SEMENYIH
Semenyih
Sg.Langat
Sg.Semenyih
Bandar Baru Rinching
Broga
DENGKIL
Sg.Semenyih
Bangi
Sg.Beranang
BERANANG
Sg.Beranang
Ulu Beranang
LENGGENG
SEPANG
Beranang
Sg.Pajam
Pajam
Sg.Lenggeng
Lenggeng
SETUL
SEREMBAN
Mantin
Sepang Road
Salak
LABU
NEGERI SEMBILAN
Labu
LABU

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 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 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.

MONITORING OF WATER RESOURCES

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

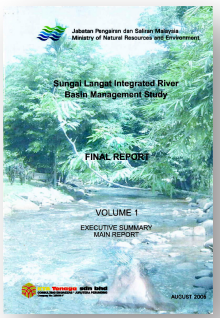
A number of agencies monitor water resources and water quality throughout the river basin. One of them is Lembaga Urus Air Selangor (LUAS), a water resources management body that monitors and enforces control over human activities for the management of water resources, river basins, water bodies, ground 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

RIVER BASIN PLANNING



Integrated River Basin Management

In 2005, an Integrated River Basin Management Study commissioned by Jabatan Pengairan dan Saliran (JPS) was carried out for the Sg. Langat basin. It combines the various uses, issues and opportunities into a single action plan that extends until the year 2020. River planners will find it is useful to benchmark the actions listed below against the progress made up to the year 2011.

Main Issues and Action Plans for Sg. Langat Basin
Prevent water quality degradation
Manage water demand and supply
Mitigate the frequency of floods
Reduce frequency of flooding
Rehabilitate eroding river banks
Manage river sand abstraction
Enhance river-related sites for recreation and tourism
Enhance navigational use of the river channel

Source: Study on Integrated River Basin Management Plan for Sg. Langat 2005

Subsidiary Legislation

The state of Selangor has gazetted several rulings to protect several areas within the river basin.

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

In the same year, another ruling, *Zone of Protection (Declared Area and Restriction) No. 2) Notification 2010* was gazetted. This legislation is to protect and reserve 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 Task Subang Dam.

Clear waters of Sg. Congkak flowing through Hulu Langat

WATER RESOURCES AND SUPPLY

SURFACE WATER

Sg. Langat is the main water supply for Putrajaya, Sepang, Kajang and Kuala Langat. It also supplies water to other areas such as Federal Territory of Kuala Lumpur, Shah Alam, Klang, Petaling Jaya, Keramat, Wangsa Maju and Kelang Lama. The water is supplied to the people for daily, commercial, agricultural and industrial usage.

A total of eight water treatment plants (WTPs) are operated by Puncak Niaga (M) Sdn. Bhd. (PNSB) and one WTP operated by Konsortium ABASS Sdn. Bhd. (ABASS) within the Sg. Langat basin. There are 8 water intake points in the basin.

Puncak Niaga is one of the water treatment suppliers in the state. It has 29 plants and 49% of treated water distributed to five million domestic agricultural and industrial end-users

ABASS is the water supplier for the Semenyih Water Scheme that comprises the Semenyih Dam, WTP in Putrajaya, WT1 in Jenderam and WT2 in Hulu Semenyih

	WTP	Raw water source
1	*Sungai Lolo*	*Sungai Lolo*
2	*Sungai Pangsoon*	*Sungai Pangsoon*
3	*Sungai Serai*	*Sungai Serai*
4	*Sungai Langat*	*Sungai Langat*
5	*Cheras Batu 11*	*Sungai Langat*
6	*Sungai Semenyih*	*Sungai Semenyih*
7	*Bukit Tampoi*	*Sungai Langat*
8	*Salak Tinggi*	*Sungai Labu*

WTPs within the Sg. Langat basin
Source: SYABAS EIS 2011

Water Reservoirs

Langat Dam
Catchment: 54 km^2
Dam area: 2.5 km^2
Capacity: 37,480 ML
Yield: 477 MLD
Type: Earth embankment

Semenyih Dam
Catchment: 41 km^2
Dam area: 2 km^2
Capacity: 59,071 ML
Yield: 545 MLD
Type: Earthfill

There are two dams, the Langat Dam and the Semenyih Dam. The Langat Dam, built in 1981, has a catchment area of 54 km², while the Semenyih Dam, built in 1982 to supply domestic and industrial water, has a catchment area of 41 km². In addition to supplying fresh water by regulating stream flow at the intake point, the reservoirs are also important in controlling flood discharges at downstream sections of the river basin. The Langat Dam is managed by Puncak Niaga Sdn. Bhd. (PNSB), while the Semenyih Dam by Konsortium ABASS Sdn. Bhd. (ABASS). There is a third reservoir for Putrajaya Dam, but it is used for recreation and not for water supply.

Semenyih Reservoir in Hulu Langat

Production Capacity

For the last three years, water treatment plant production has been exceeding design capacity. For example, the biggest treatment plant within the catchment, Sungai Langat WTP, processed 452 MLD of raw water against its design capacity of 386 MLD in 2011.

WTP	2009		2010		2011	
	Design Capacity	Production	Design Capacity	Production	Design Capacity	Production
	(In MLD)					
Sungai Langat	386	458	386	455	386	452
Cheras Batu 11	7	22	27	26	27	26
Bukit Tampoi	32	26	32	31	32	34

Water Treatment Plant Production and Capacity
Source: SPAN

Issues

One of the biggest issues regarding water treatment is the poor quality of the raw water in the river. This is due to several causes.

Leachate from landfills. In 2010, ABASS had to shut down the plant several times due to runoff of ammonia nitrogen from nearby operational and disused landfills seeping into the river waters. In one case at the Pajam landfill, the earth bund surrounding the fill collapsed, causing leachate to seep into the waterways. At other times, overtopping of the bund due to heavy rain caused leachate to flow into the river.

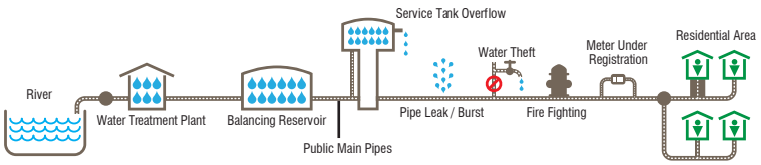
Sedimentation. High turbidity caused intake points to choke up and treatment plants are forced to stop operations. Sources of sedimentation in the Hulu Langat area were sand mining, earthworks from housing developments and riverbank erosion. This has negative repercussions on water treatment operators as adding more chemicals to treat heavily polluted water adds to the mounting cost of treatment.

Non-point solution. Non-point source pollution, which is pollution whereby the source cannot be directly traced, is also a problem. During heavy rains, first flush rainwater carries high amounts of diesel from

automotive workshops. If the amount of diesel is high, treated water still carries the smell of the substance, and the entire batch of processed water is rejected. ABASS suggests that land use be planned such that all industries are consolidated into a single zone for better monitoring and management of effluents.

Non-revenue water. 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.

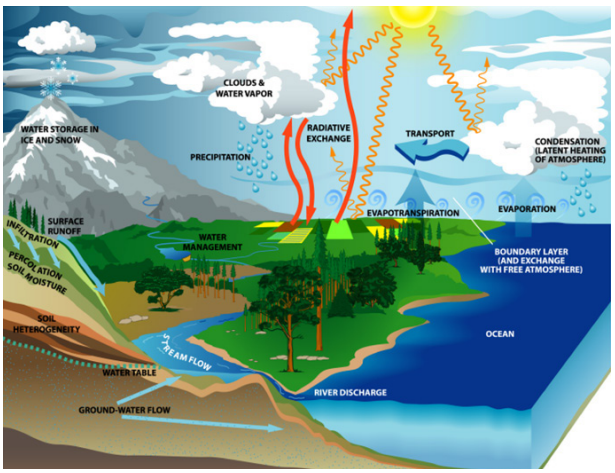
Actions Taken

To prevent any further leachate from spilling out of the Pajam landfill, a leachate treatment plant is currently being constructed and is expected to open in June 2012. The bund surrounding the fill is also being repaired. At the same time, a more suitable location for the landfill is being explored, such as Tanah Merah, Negeri Sembilan.

GROUND WATER

Ground water is water under the ground surface that fills spaces between sand grains, in rock crevices and in solution openings. Within LUAS, ground water refers to 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^3, which is the summation of surface runoff and ground water recharge. This translates into an annual average water availability of approximately 28,400 m^3 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^3
Surface runoff	566 billion m^3
Evapotranspiration	360 billion m^3
Ground water recharge	360 billion m^3
Surface artificial recharge	25 billion m^3
Ground water recharge	5,000 billion m^3

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
150 mm	3,350 MLD

Source: LUAS

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.

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

As of 2011 there were 21 licensees of ground water abstraction in the Sg. Langat basin. This is a reduction from 32 licensees in 2010 and 33 in 2009.

	2009	2010	2011
Number of ground water licensees	33	32	21

Source: LUAS 2012

According to NAHRIM, there are areas in the Langat basin with significant potential for further ground water development. NAHRIM has identified three more viable ground water wells in Jenderam Hill and Dengkil in 2011.

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 Berhd (PNSB), Kumpulan Darul Ehsan Berhad (KDEB) and Perbadanan Kemajuan Pertanian Selangor (PKPS)

Source: LUAS 2012

LAKES AND EX-MINING PONDS

There are 26 lakes and ex-mining ponds in the basin, out of which three have been identified as alternative water resources. All are located in Kuala Langat. They are Agrotek in Olak Lempit; Lombong Bukit Chending; and ex-mining pond near the ELITE Highway in Saujana Putra.

District	Name of pond	Location	Hectare
Hulu Langat	Bekas lombong Kg. Sg. Kembong	Beranang	90.00
	Kolam Kg. Sg. Sementa	Beranang	30.00
	Kolam Kg. Pasir	Semenyih	15.00
	Kolam Sg. Batangsi	Hulu Langat	30.00

	Kolam KISDAR/KUIS	Bangi	40.00
	Kolam Teratak Tekala,	Hulu Semenyih	30.00
	Kolam hadapan UKM	Bangi	9.00
	Bekas lombong	Bukit Mahkota	90.00
	Kolam takungan Sg. Chua	Kajang	17.00
	Kolam tepi tol	Bangi	25.00
	Kolam Country Height		
Sepang	KT. Seri Kenangi		9.80
	KT Kg. Baru Dengkil	Dengkil	9.80
	KT Tepi Sg. Langat	Nam Tak	29.60
	Sg. Langat, Kuala Sg.	Kuala Sg. Labu	10.00
	Kolam takungan tepi Sg. Langat	Ampar Tenang	10.00
	Kolam takungan Kolam PUAS	Janda Kalim	101.30
	Kolam takungan tepi Sg. Semenyih	Kg. Sg. Buah	49.40
Kuala Langat	Lombong pasir	Labohan Dagang/ Brooklands	500.00
	Lombong Bukit Cheding	Kuala Langat	500.00
	Paya Indah Wetland	Dengkil	
	Lombong Agrotek Ace	Olak Lempit	180.00
	Tasik bersebelahan Agrotek	Olak Lempit	250.00
	Tasik bersebelahan Agrotek	Olak Lempit	40.00
	Lombong		30.00
	Kolam Bekas Lombong	Saujana Putra	100.00
		TOTAL	**2,195.90**

Source: LUAS 2012

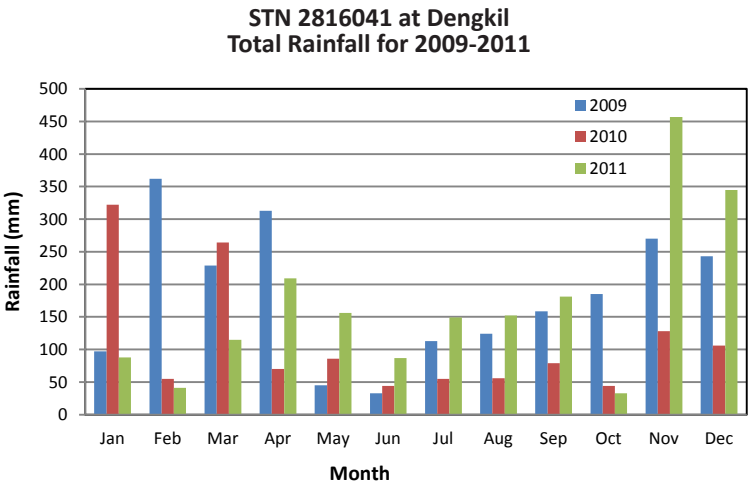
These ponds are monitored by Jabatan Kesihatan Negeri Selangor (JKNS) as alternative water supply in the event of water shortage from rivers and dams. Arsenic in the water is a concern as long-term exposure can cause cancer in the skin, lungs, and bladder as well as cause thickening and pigmentation of the skin.

Based on the results received from JKNS' Department of Chemistry and National Public Health Laboratory (MKAK), it was found that there were some ponds in the basin in 2011 that had shown presence of leptospira, aluminium and iron, and therefore did not meet quality standards.

However, JKNS advises that water contaminated with the bacteria can be treated with conventional chlorination treatment. The agency recommends that water should be abstracted at least one foot above the bottom of the pond to avoid intake of heavy metal that has settled.

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. From the total monthly rainfall readings at the station at JPS Wilayah for years 2009 to 2011, it can be seen that most of the 2011 rainfall occurred in the months of November and December.

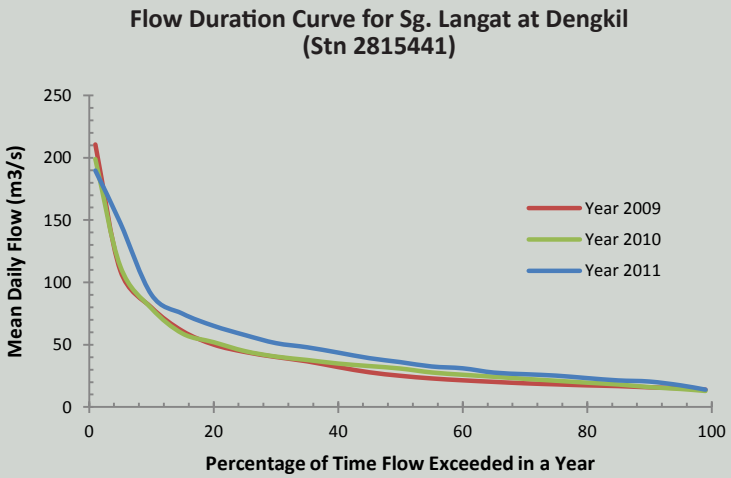


Source: JPS 2012

FOCUS
Flow Duration

Indicator 1: Availability of Water in Sg. Langat

One of the ways to assess water availability is the observation of 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.



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, 65 m^3/s of water flowed through Sg. Langat for 20% of the time in 2011; only 52 m^3/s flowed for the same time in 2010 and 2009. After allowing for water reserved for environmental flow and allocated abstraction uses, river planners and users can budget the remaining water for other uses, such as river-related projects and activities.

Man-made lakes such as Putrajaya Lake plays an important role in tourism

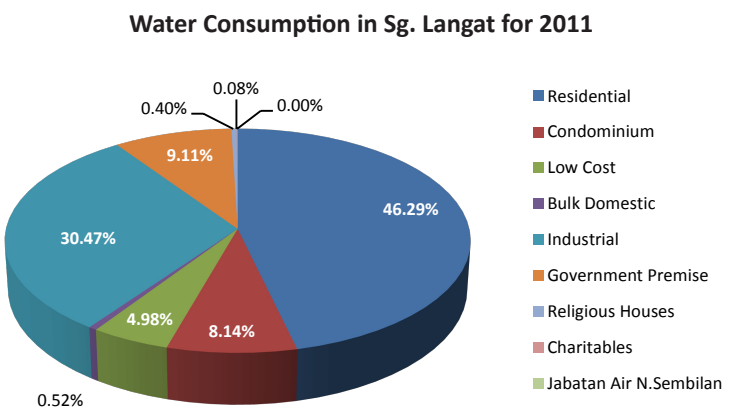
WATER CONSUMPTION AND ABSTRACTION

Water consumption is the amount of potable water billed to the consumers. The consumption for Petaling, Hulu Langat, Sepang and Kuala Langat districts in the Sg. Langat basin in 2009 was 412 million m^3. This includes domestic (residential, condominiums, low cost and bulk domestic), non-domestic (industrial and shipping), and others. The figure was 430 million m^3 in 2010, and 442 million m^3 in 2011.

Year	Water Consumption (M)
2009	411.80 m^3
2010	429.89 m^3
2011	441.58 m^3

Source: SYABAS 2012

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



Source: SYABAS 2011

Although industrial water consumption ranks second to residential consumption, demand for industrial use water is growing. Steel manufacturing entities such as Megasteel currently uses 6 million gallons of ground water per day (MGD). With additional steel producing facilities, it now requires surface water for its operations.

Starting in 2008, the Selangor State Government has been providing 20m³ 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.

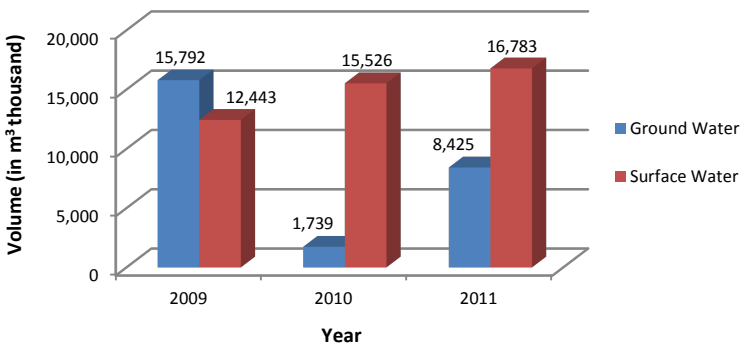
Tighter control over abstraction of surface and ground water is being gazetted whereby licensing of abstractors, conditions and requirements for abstraction, and monitoring and declaration of amount abstracted

can be closely managed by LUAS. Any infractions in requirements shall be met with corrective or punitive measures by LUAS.

Abstraction of surface and ground water licensed by LUAS within the Sg. Langat basin varies from year to year. For surface water, there is a steady rise from approximately 12 million m^3 in 2009 to 15 million m^3 in 2010 and 16 million m^3 in 2011.

There is more fluctuation in the abstraction of ground water over the three years, from approximately 16 million m^3 in 2009 to 2 million m^3 in 2010 and 8 million m^3 in 2011.

Comparison of Licensed Ground and Surface Water Abstracted within the Sg. Langat 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/m³, while water for domestic supply purposes is RM0.01/ m³.

Water Abstraction	Rates
Commercial	RM 0.05 /m³
Water Supply	RM 0.01 /m³

Source: LUAS 2011

Total Water Abstraction

In 2011 there were eight water treatment plants and 33 industrial and private facilities that abstracted surface water from within the basin.

Facility	Number		
	2009	2010	2011
Water Treatment Plant	8	8	8
Industrial / Private	30	29	33

Source: LUAS, PNSB, ABASS 2012

Water Abstraction by Water Concessionaires

Syarikat Bekalan Air Selangor Sdn. Bhd. (SYABAS) is the distributor of potable water to the consumer. Water extraction and treatment is divided between two water concessionaires.

SYABAS is the state's water distribution company

ABASS is the concessionaire in charge of the **Semenyih Water Scheme**. The Semenyih Dam, which covers an area of 5,692 hectares, releases water to Sg. Semenyih. The dam also provides water to Sg. Langat during drought periods. Downstream, an intake sump and pump station at Jenderam Hilir extracts water from Sg. Semenyih, which is then treated at the Sungai Langat 1 Plant at Precint 19 in Putrajaya. From there, SYABAS supplies water to about 1.4 million users, or to about 300,000 domestic and commercial accounts.

A notable feature of the Semenyih Water Treatment Plan is a sludge treatment facility that processes 600 metric tonnes of sludge daily. It

employs the 'zero discharge' concept, where all the liquids recovered from the various stages of treatment will be recycled back into the water treatment plant.

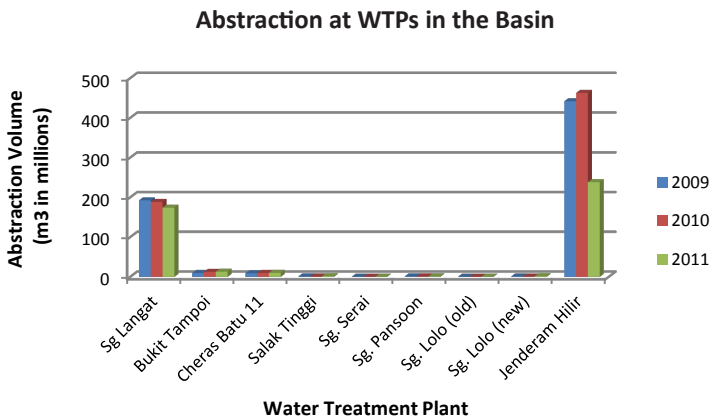
The other major water treatment scheme is the **Langat Water Scheme**, which is owned and managed by PNSB.

In 2009, the amount of raw water abstracted from rivers was 433.52 m^3 (578 MLD). The number jumped to 439.53 m^3 (582 MLD) in 2010 and to 410.03 m^3 (582 MLD) in 2011.

No	Water Treatment Plant	Operator	2009	2010	2011
			Abstraction (m^3 in millions)		
1	Sg. Langat	PNSB	192.65	188.57	174.08
2	Cheras Batu 11	PNSB	9.18	9.88	10.11
3	Bukit Tampoi	PNSB	9.86	12.57	12.89
4	Sg. Lolo	PNSB	1.26	1.23	2.25
5	Sg. Pangsoon	PNSB	1.43	1.40	1.12
6	Sg. Serai	PNSB	0.28	0.37	0.41
7	Salak Tinggi	PNSB	1.38	1.06	1.75
8	Sg. Semenyih	ABASS	217.46	224.43	238.41
		Total	**433.52**	**439.53**	**441.03**

Water abstracted from the Sg. Langat basin
Source: LUAS 2012

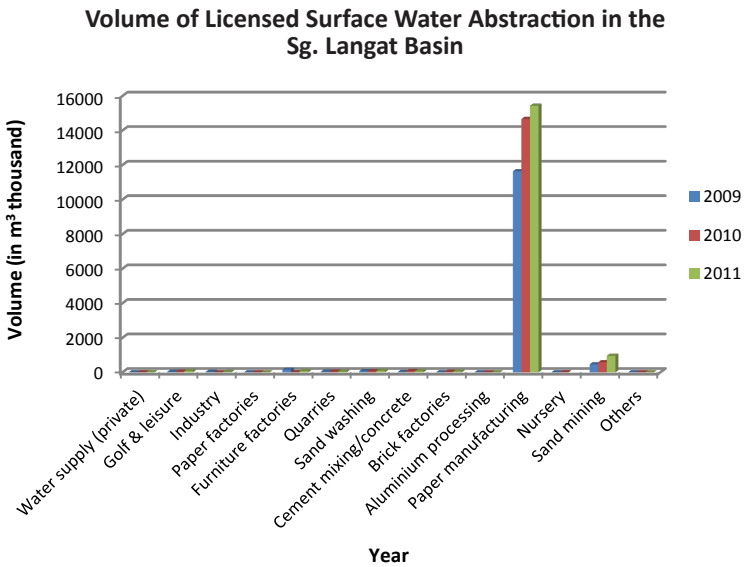
In terms of abstraction volume, the most was taken at the Sg. Langat and Sg. Semenyih WTPs.



Distribution of abstraction among WTPs
Source: LUAS, Puncak Niaga and ABASS 2012

Water Abstraction by Industry

A total of 154 licenses for ground water and 137 licenses for surface water abstraction were issued by LUAS in 2011 throughout Selangor. Within the Sg. Langat basin, 48 licenses were issued by LUAS. The single biggest abstractor of surface water is the paper manufacturing industry at over 11 million, 14 million and 15 million m^3 abstracted in 2009, 2010 and 2011. The next biggest abstraction activity, sand mining, trails at 953,949 m^3 in 2011. Other significant activities in 2011 were cement mixing/concrete (60,000 m^3), golf and leisure (68,832 m^3), sand washing (85,848 m^3) and brick manufacturing (49,490 m^3).



Source: LUAS 2012

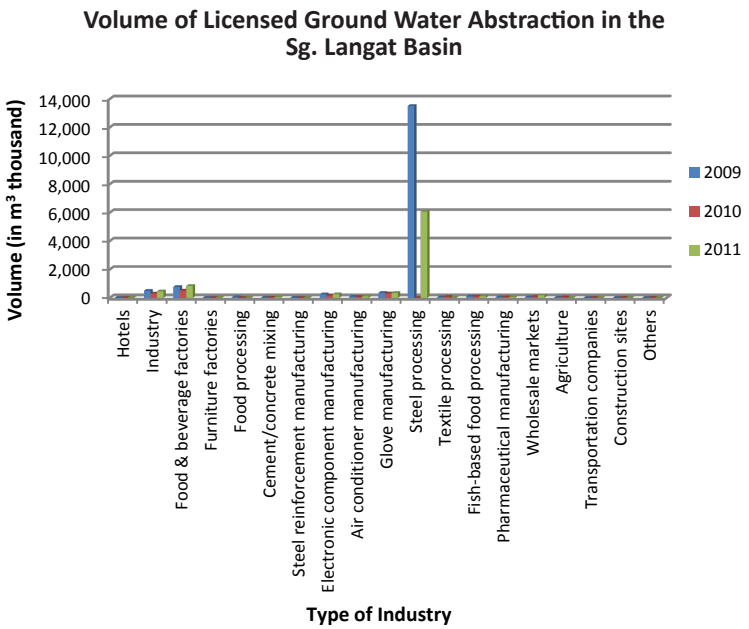
Water Abstraction for Irrigation

The irrigation water demand in Selangor is largely confined to the Northwest Selangor Integrated Agricultural Project in the northern part of the state, specifically the Sabak Bernam basin. Most of the 17 minor irrigation schemes in Selangor totaling 2,238 hectares are located in the districts of Hulu Langat and Hulu Selangor. Many of these small schemes have been abandoned as a result of lack of labour in rural areas and out-migration of workers, leading to an overall low cropping intensity. Others have been used for housing the close proximity for urban areas means that in the long term, the remaining schemes are also likely to be converted to housing or cultivation of higher value crops.

Clear waters of Sg. Langat flow near the Puncak Niaga intake plant in Hulu Langat

ABSTRACTION FROM GROUND WATER

Usage of ground water in the Sg. Langat basin is dominated by the steel processing industry with 14 million m^3 abstracted in 2009 and 6 million m^3 in 2011. Other significant ground water abstractors in 2011 are from food and beverage factories (835,828 m^3), general industry (453,097 m^3), electronic component manufacturing (250,098 m^3) and glove manufacturing (332,880 m^3).



Source: LUAS 2012

ABSTRACTION FROM LAKES AND EX-MINING PONDS

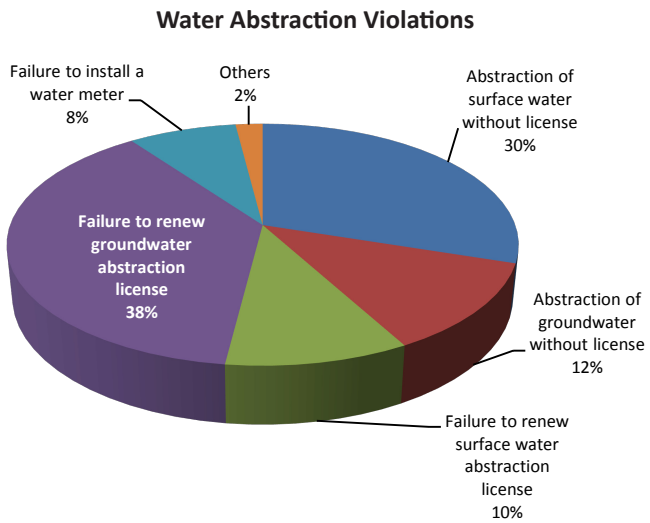
Ex-mining ponds provide vast supply as alternative water sources. As mentioned earlier in this section, there are 26 lakes and ex-mining ponds that cover over 2,000 hectares of water supply. The depths vary from shallow to very deep, and are monitored by JKNS as potable water supply.

There is a defunct mining pond in the Olak Lempit Industrial Area in Mukim Tanjung Dua Belas of the Kuala Langat district that is of particular interest. Called MC8–MC9, the pond was abandoned by Selangor Dredging Berhad a few years ago. It is very large, covering approximately 150 acres of land and deep at –53.34 m LSD. If tapped as a water resource, the pond can provide approximately 20 MCM of water.

Aerial view of the M8-MC9 pond in Mukim Tanjung Dua Belas

Issues

In 2011, LUAS issued 144 violation notices for commercial water abstraction. Out of this, 29.9% were for abstraction of surface water without a license, 11.8% were for abstraction of ground water without a license, 10.4% for failure to renew surface water license, 37.5% for failure to renew ground water license, 8.3% for failure to install a meter, and 2.1% for others.



Source: LUAS 2012

SUSTAINABLE WATER PRACTICES

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

Rainwater harvesting is one of the best management practice that is being promoted in Malaysia. The system slows the flow of surface runoff, and as such serves as 'on site detention storage' as well as a source of water. However, as rainwater may contain traces of chemicals that may be harmful as drinking water, harvested rainwater is best used to flush toilets, water plants, wash cars and other external uses.

PPj manages and administers the Federal Territory of Putrajaya and is entrusted with the function of the local authority and local planning authority

Under Perbadanan Putrajaya, there is a rainwater harvesting project in Precinct 16 called the Green Landscape Area. It follows guidelines from the Ministry of Housing and Local Government. One of the issues it is dealing with is control over mosquito breeding.

LUAS is also proposing rainwater harvesting in locations throughout the basin, such as the developments involving 2-storey bungalows at Lot 6056 and 6058 in Mukim Dengkil.

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. Meanwhile, nine rivers in Selangor were classified as polluted in year 2010 compared to ten in year 2009.

Within the Sg. Langat catchment, there are 12 JAS monitoring stations along the major rivers and tributaries for water quality. These stations monitor six parameters, which are biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammoniacal nitrogen (NH_3–N), pH, dissolved oxygen (DO), and suspended solids (SS).

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

The WQI for the Sg. Langat was 71 in 2009 and 72 in 2010, which fall under Class III. This means that the river water requires extensive treatment before it is suitable for human consumption. There have been

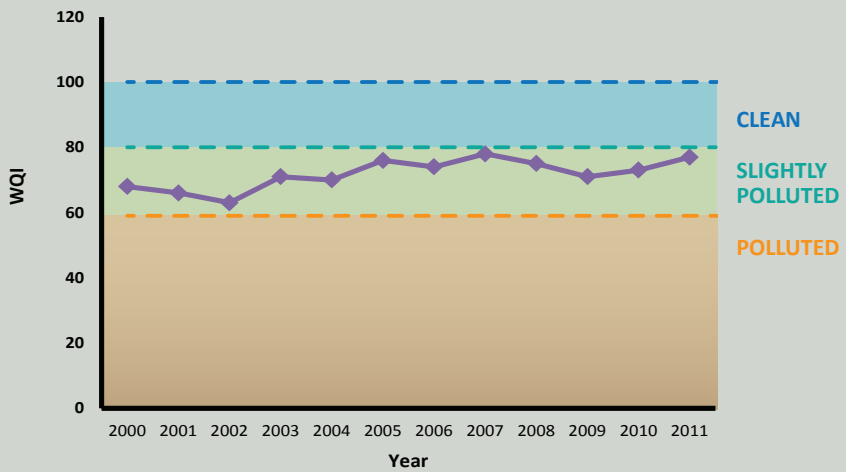
four improvements in WQI in four of the rivers: Anak Chuau, Buan, Lui, and Limau Manis, with the latter showing a drastic improvement from Class III to I. Only Semenyih shows a decrease from Class II to III.

FOCUS
Water Quality

Indicator 2: Water Quality in Sg. Langat

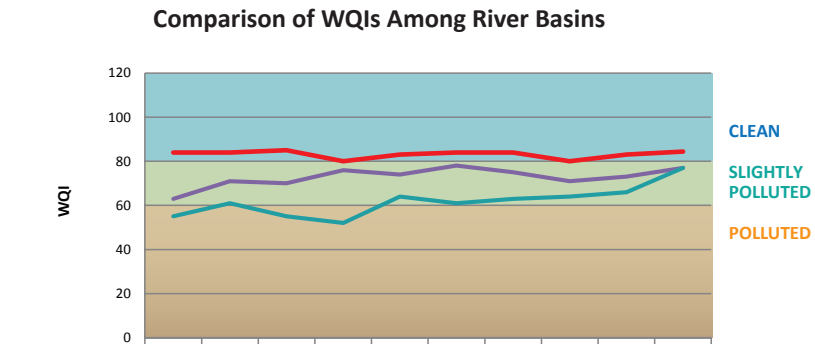
The WQI for Sg. Langat in 2011 showed a marked improvement over its previous years. Since 2007 the water quality has shown an upward trend. In 2011, the WQI was 77, an improvement of 20% and 17% over the WQI of 64 in 2009 and 66 in 2010.

Water Quality of the Sg. Langat Basin in 2011



Source: JAS Selangor 2011

In comparison with Sg. Klang and Sg. Selangor river basins, Sg. Langat ranks mid-range between the relatively clean Sg. Selangor and the more polluted Sg. Klang, although all three rivers show evidence of steadily improving WQI over the past three years.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Sg. Langat	63	71	70	76	74	78	75	71	73	77
Sg. Selangor	84	84	85	80	83	84	84	80	83	85
Sg. Klang	55	61	55	52	64	61	63	64	66	77

Source: JAS Selangor 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.

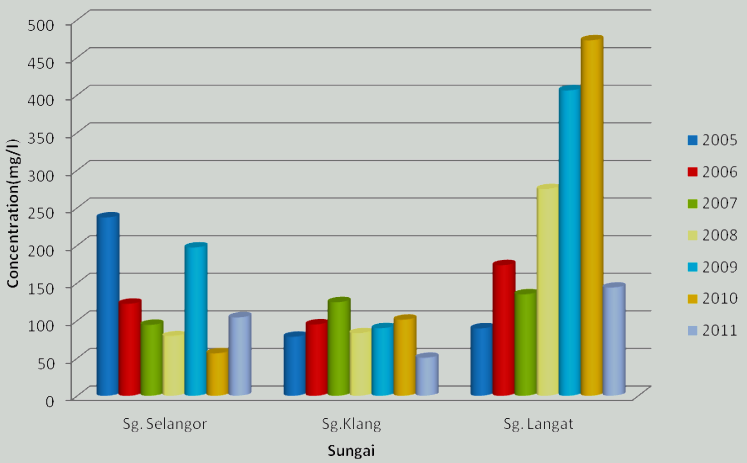
FOCUS
Water Quality

Indicator 3: Total Suspended Solids in Sg. Langat

In the year 2010, the level of pollutant concentration for the parameter suspended solids (SS) in Sungai Langat rose drastically from the previous year. SS, or total suspended solids (TSS), is a measure of how much sediment is in the river water. Activities that contributed to the rise in concentration levels were soil erosion, earthworks, and sand mining.

A comparison of TSS levels in other river basins shows that Sg. Langat fared the worst in terms of turbidity. In 2010, the TSS level was more than 4 times the level in Sg. Klang and 8 times the level in Sg. Selangor.

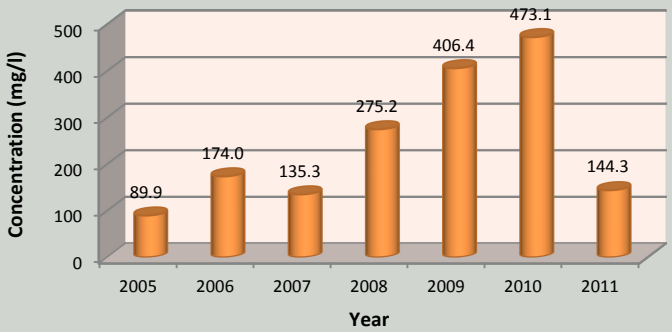
Trendine Comparison of TSS Among River Basins



Source: JAS Selangor, Laporan Tahunan 2011

However, in 2011 the TSS level in Sg. Langat decreased to that almost comparable to the other river basins.

Trendine for TSS in Sg. Langat from 2005 to 2011



Source: JAS Selangor, 2011

Ammoniacal Nitrogen

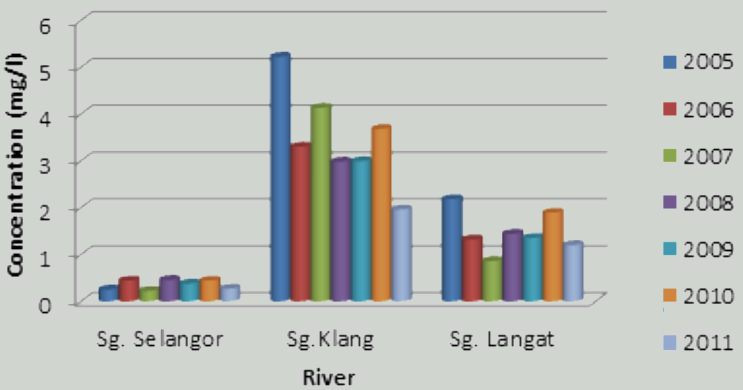
Depending on temperature and pH, high levels of ammoniacal nitrogen (NH_3–N) can be toxic to aquatic life. High concentrations can stimulate excessive aquatic production and indicate pollution. Sources of ammonia include fertilisers, human and animal wastes and by–products from industrial manufacturing processes.

FOCUS
Water Quality

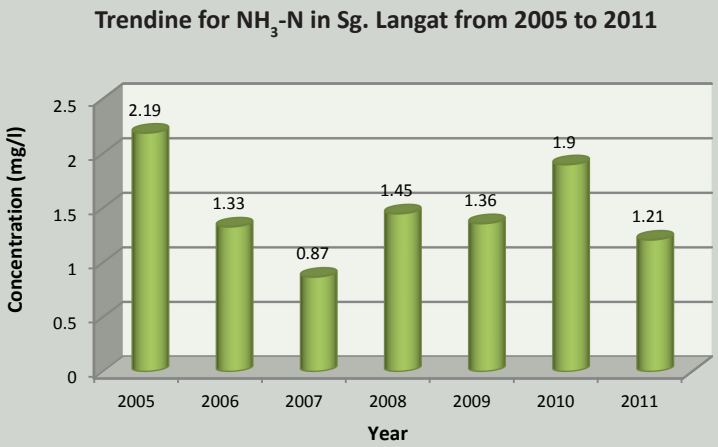
Indicator 4: Ammoniacal Nitrogen in Sg. Langat

Concentration levels for NH_3–N in Sg. Langat showed moderately high levels although there is a drop in 2011. NH_3–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. Langat, the main causes of the increase are from the release of untreated sewage or partially treated effluents and agricultural activities.

Trendine Comparison of NH_3-N Among River Basins



Source: JAS Selangor, Laporan Tahunan 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.

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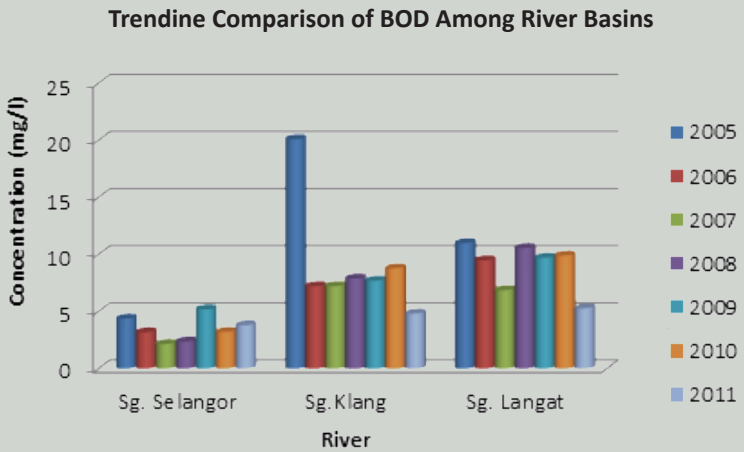
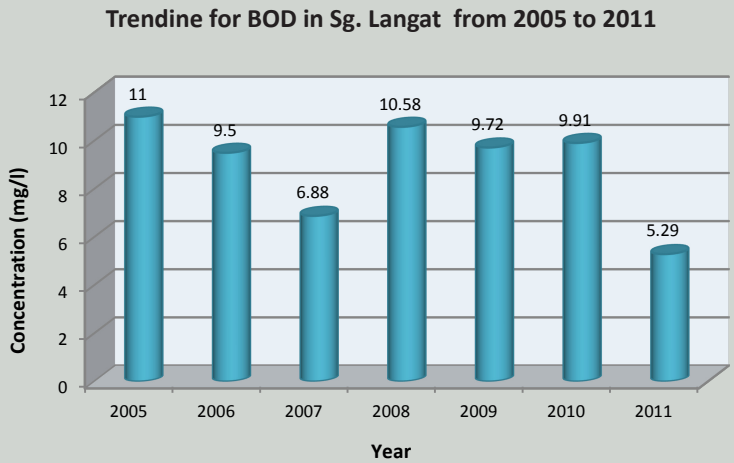
Water Quality

Indicator 5: Biochemical Oxygen Demand in Sg. Langat

BOD level during the year 2011 is the lowest since 2005. 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.



Source: JAS Selangor, Laporan Tahunan 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.

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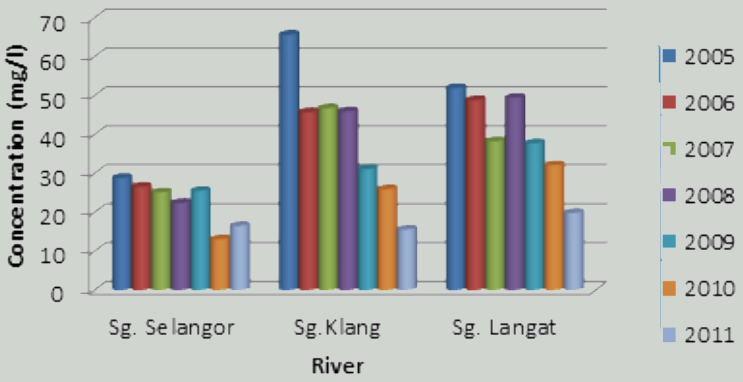
Water Quality

Indicator 6: Chemical Oxygen Demand in Sg. Langat

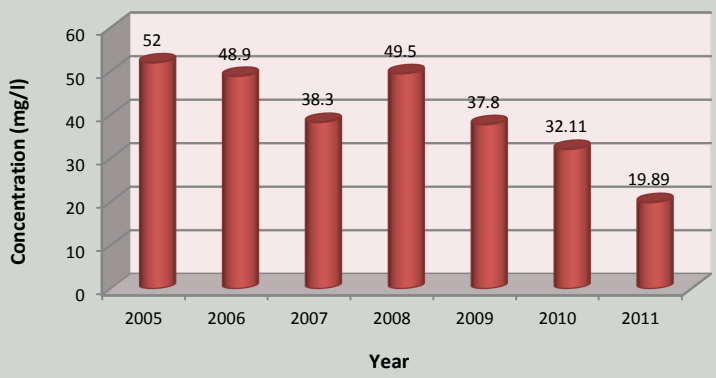
The COD level in Sg. Langat is also the lowest since 2005. COD is an indicator of the quality of effluents and wastewaters prior to discharge. It is a measure of the total quantity of oxygen required to process both biological and inert organic matter. It is often used in monitoring and control of discharges, and for assessing treatment plant performance.

Trendine Comparison of COD Among River Basins



Source: JAS Selangor, Laporan Tahunan 2011

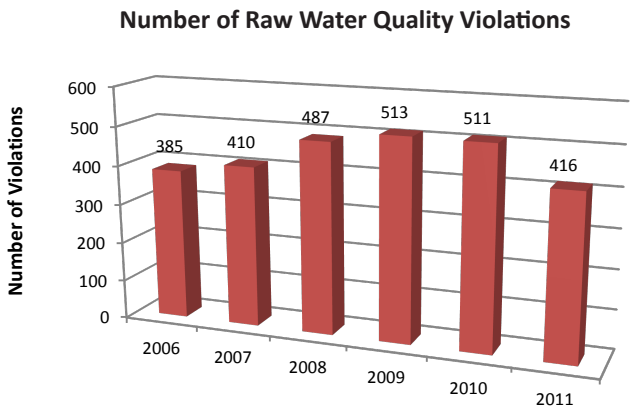
Trendine for COD in Sg. Langat from 2005 to 2011



Source: JAS Selangor, 2011

Issues

Violations and Enforcement. Overall, Sg. Langat recorded the highest number of raw water quality violations when compared to the Recommended Raw Water Quality Standard (National Standard for Drinking Water Quality, Ministry of Health, Malaysia). According to Puncak Niaga, there were 416 recorded violations in 2011.



Source: SYABAS EIS 2011

From 1995 to 2011, a total of 6,634 violations were detected within the catchment. Based on the monitoring, the parameters that recorded violations in 2011 were total coliform, turbidity, colour, pH, BODs, COD, nitrate, iron, silver, and gross alpha radiation.

The results show that WTPs that were located at the lower part of the moderately developed catchment areas such as Sungai Langat WTP, Cheras Batu 11 WTP, Bukit Tampoi WTP, and Salak Tinggi WTP recorded some of the highest number of violations.

According to Puncak Niaga, all water intakes that abstracted raw water directly from the rivers were generally ranged from Class I to III. Better raw water quality of Class I and II were abstracted from the tributaries.

WTP Station	2009		2010		2011	
	WQI	Class	WQI	Class	WQI	Class
Sg. Langat	83.6	II	84.5	II	86	II
Bukit Tampoi	68.7	III	73.6	III	76.2	III

Cheras Batu 11	68.4	III	67.4	III	74.4	III
Salak Tinggi	70.5	III	66.5	III	71.4	III
Sg. Pangsoon	94.3	I	94.8	I	93.3	I
Sg. Lolo	93.6	I	94.3	I	93.8	I
Sg. Serai	93.8	I	93.3	I	92.6	II

Classes of WTP at intake points
Source: PNSB 2012

Sources of pollution in the basin were sand mining, stone quarries, landfills, industrial, commercial and domestic activities.

Actions Taken

In response to the violations, stringent monitoring activities have been undertaken. In addition to JAS, other agencies and private entities such as SYABAS, LUAS, PNSB, ABASS and JKNS have been conducting water quality testing and sanitary surveys. Data gathered and relevant information is centralized at LUAS so that an integrated, concerted effort towards enforcement, issues resolution and problem solving can be made.

Monitoring by ABASS. ABASS had concerns about the raw water source from Semenyih passing through Bangi, Kajang, Nilai and pollution from industrial area. As an initiative to overcome the pollution that comes from the industrial areas, ABASS has set up 15 sampling points that are monitored monthly from Semenyih to the water intake. Typically, results showed that one sampling point out of the 15 is Class I, some points close to Nilai is Class III, and the rest Class II.

Source: LUAS 2012

Monitoring by Puncak Niaga. Puncak Niaga actively conducts annual environmental impact studies of six water catchments in Selangor and the Klang Valley. It carries out land use assessment as well as monitor raw water quality at water intake points. It monitors for microbiological, physical, heavy metals, pesticides, and radioactivity according to the National Raw Water Quality Standard.

Monitoring by JKNS. JKNS also has a program for continuous monitoring through sanitary surveys. Its team tests river water at water intake sites and alerts LUAS when any significant potential health threat is detected. LUAS then calls the party responsible for the source of the pollution, water concessionaire, and other related parties for pollution mitigation. The Department has also proposed a Water Safety Plan in 2011 and is expected to be tabled in Parliament in 2012.

Source: Puncak Niaga

According to PNSB, in view of the rapid population growth, industrialization, and uncertainties caused by climate change, additional strategies for managing raw water resources sustainably needs to be developed. This is to ensure that sufficient quantity and quality of raw water is available for use by present and future residents of Selangor, Kuala Lumpur, and Putrajaya.

PNSB suggests that there should more awareness of the violations being made so that the general public becomes aware of the pollution being dumped into the rivers.

JKNS recommends that local authorities also conduct a sanitary survey of their section of rivers by district. This would enable comparison of the quality of raw water and treated water.

Water Quality of Coastal Waters

JAS has set up four monitoring stations in estuaries and coastal areas in the Sg. Langat Basin to observe marine water quality for purposes of recreation, fishing and marine parks. Three stations are located at Kuala Sg. Sepang and one at Kuala Sg. Langat (Jugra).

Throughout the coastline, JAS has marine water quality monitoring conducted at 14 stations along the sea. Overall, the parameters E. coli, total suspended solids (TSS) and oil and grease are the main pollutants in the coastal marine waters of Selangor. The recorded E. coli level exceeds the standard level. This is believed to be due to the discharge of wastewater from food shops, restaurants and domestic sewage that are not treated properly.

In addition, shipping and fishing boats have also been identified as a major contributor to the pollution of oil and grease, while earthworks activities along the coast and estuaries contribute to increased levels of high suspended solids. Naturally occurring coastal erosion can also contribute to increased levels of suspended solids.

Good water quality is important to support and sustain biodiversity of lakes and rivers within the basin

RIVER ECOLOGY

One of the sensitive ecological areas within the Sg. Langat basin is the Putrajaya Wetlands. Putrajaya Wetland is the first man-made wetland in Malaysia and the largest constructed freshwater wetland in the tropics.

The wetland straddles the water courses of Sg. Chuau, Sg. Bisa and three tributaries. The primary function of the wetland is to ensure that the water entering Putrajaya Lake meets the standard set by Perbadanan Putrajaya. It does this by acting as a filter and to serve as the 'kidneys' of the catchment to intercept water flow, trap sediment and pollutants, remove toxic substances (pesticides, herbicides, metals) and assimilate nutrients and energy derived from the upstream catchment area.

To achieve this, the wetland has been planted with a variety of aquatic plants that act as a natural filtration system, removing nutrients and pollutants from the catchment water. They treat natural run-off from the 5 km^2 Sungai Chuau catchment.

In addition to being a water cleansing and filtration system, the wetland also helps in flood mitigation, nature conservation, ecotourism, recreation, research and education and protection against erosion.

Wetland marshes serve as filters at Taman Wetlands in Putrajaya

All this serve to protect the pristine condition of Putrajaya Lake, which is an important recreational venue for its many activities, such as boat cruises, canoeing, fishing, kayaking as well as providing a site for eco-educational programmes for children and adult nature lovers alike. There are between 2 to 3 million species of flora and fauna, and it is home to birds such as flamingos, milky storks, Mandarin ducks, and Canadian geese.

In other parts of the catchment, the flora and fauna population is not as well defined. In terms of flora, dipterocarp forest remains the main forest type, but the percentage has been declining since the early 1970s. Generally the reduction in the basin is due to land conversion to agriculture, industrial and housing estates, urban areas and transportation corridors.

Aquatic fauna in the rivers in the basin area is not abundant, due to the short and fast-flowing nature of rivers which deter aquatic life.

White Pelicans and Egyptian Geese habitat the Putrajaya Wetlands

Issues

However, over the past few years, Putrajaya Lake has been seeing pollution from non-point sources infiltrating into its waters. Siltation from upstream activities has also been intruding into the wetland area. Clinical waste from the nearby hospital has also been spotted in various parts of the lake, and E. coli has been detected in these parts.

Algae bloom. The effects of such pollution have resulted in the growth of algae blooms precipitated by the presence of pesticides. Perbadanan Putrajaya has had to manually pump algae out of the water before it becomes widespread. Uncontrolled growth of water hyacinth, a pest plant, poses another threat of unwanted vegetative propagation.

Fishkill in the upper reaches of the wetland system has been occurring over the past two years. Oil spill from petrol storage facilities, although not frequent, also poses a threat.

Siltation. The biggest challenge is siltation coming into the wetlands, and Perbadanan Putrajaya has had to initiate a desilting programme of its 24 wetland cells.

Meander of Sg. Langat outside the Wetlands

Actions Taken

In response to these continued threats, Perbadanan Putrajaya conducted a study and presented a proposal for joint management of the Putrajaya Wetland/Lake system. It proposes an interim working committee chaired by LUAS and managed by Perbadanan Putrajaya. The aim is to cut through jurisdiction barriers that hamper an integrated approach to address the pollution problems.

RIVER-RELATED ACTIVITIES AND SOURCES OF POLLUTION

Sand mining, landfills, industries, domestic waste, land clearing and agro-based activities are among some of the activities that pose significant pollution risks to the water catchments.

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

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

Sungai Langat Basin Pollution Control Task Force	
Chairperson	Director of LUAS
Secretariat	LUAS
Committee Members	SPAN, JPP, JPBD, JMG, JPV, UPEN, JP, JAS, JPS, JKNS, JP, JP, district and land offices, local authorities, SYABAS, PNSB, ABASS, 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.

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

Source: LUAS 2012

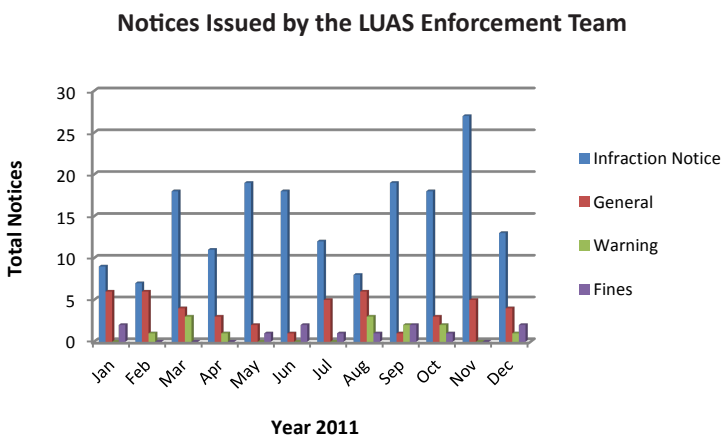
There were three major cases of disruption of services at LPAs in 2009, five cases in 2010, and a number of cases involving sedimentation, illegal alteration of resources, and illegal abstraction of surface water over the three years.

River	Type	Source	Impact
2009			
Sg. Labu	Ammonia	Effluent from factories and STPs	Disruption of service at LPA Salak Tinggi for 49 hours
2010			
Sg. Langat	Diesel	Brick processing factory	Disruption of service at LPA Cheras Batu 11 for 7.5 hours
Sg. Langat	Sedimentation	Sand mining	Causes siltation in parts of the river
2011			
Sg. Semenyih	Sedimentation	Runoff from housing development	Causes siltation in parts of the river

Typical cases monitored in 2009, 2010, and 2011
Source: Pollution Control Unit, LUAS

Enforcement. To stem the tide of infractions, enforcement has been imposed through a multi-agency effort involving the Enforcement Unit of LUAS, Suruhanjaya Pencegahan Rasuah Malaysia (SPRM), land and district offices, JAS, SYABAS, water concessionaires, the police, among others. Actions taken have included seizures, penalties and arrests.

Altogether, 417 notices have been issued in 2010 and 2011. In 2011 alone, there are 250 actions taken by the LUAS enforcement team.



Source: LUAS 2012

SEWAGE

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 451 public sewage treatment plants and 98 network pumping stations in the Sg. Langat basin. These plants fall under the operation and maintenance of Indah Water Konsortium (IWK). IWK manages public plants only; those under private ownership are responsible for their own operation and maintenance.

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

	2009	2010	2011
Total Network Pump Station (NPS)	78	94	98
Total Communal Septic Tank (CST)	102	102	102
Total Sewage Treatment Plants (STPs)	416	433	451

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
Category 1		
Mechanised Cat 1 (STD A)	2	570
Mechanised Cat 1 (STD B)	4	1,015
Total	**6**	**1,585**
Category 2		
Mechanised Cat 2 (STD A)	142	569,270
Mechanised Cat 2 (STD B)	102	247,735
Total	**244**	**817,005**
Category 3		
Mechanised Cat 3 (STD A)	121	497,669
Mechanised Cat 3 (STD B)	27	62,042
AL (STD A & B)	9	49,365
OP (STD A& B)	20	45,365
IT (STD A & B)	23	20,592
Total	**200**	**675,033**

Classification of STPs within the Sg. Langat 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.

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 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.

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).

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. 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
Ageing infrastructure	Some of the older facilities need to be upgraded to regulatory standards
Illicit connections	Cause contaminated wastewater or chemical or toxic substances enter into sewers or directly into existing standard domestic sewers before receiving treatment from a wastewater treatment plant

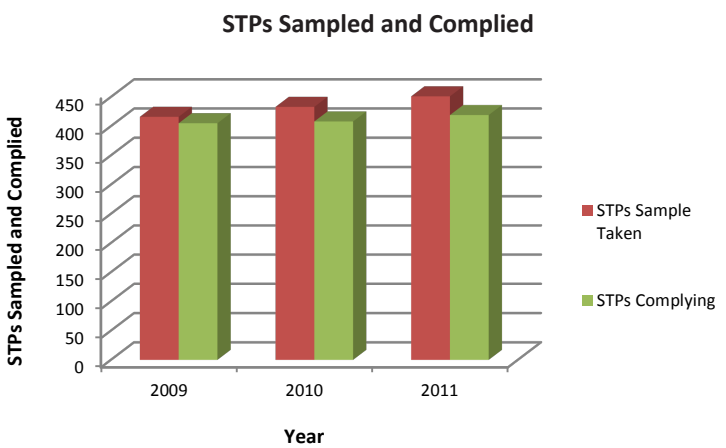
Source: IWK 2012

The impact of effluents containing high organic content on river water quality was particularly visible within the Sg. Labu sub-catchment, whereby the poor water quality of the catchment area (Class III) was the result of receiving combined effluent discharges from STPs, industrial activities and non-commercial activities located upstream. Moreover, low flow in Sg. Labu, caused by the absence of rain and the ongoing dry spell could further exacerbate the water quality of Sg. Labu.

Actions Taken

Every three months, LUAS holds discussion with river stakeholders on river pollution. IWK contributes data on public STPs. However, IWK maintains it is not the only source of pollution as there are private STPs and septic tanks that also contribute to pollution.

In response to these issues, IWK monitors its STPs in the Sg. Langat basin for effluent compliance in accordance to EQSR 2009. The total number of STPs was 416, 433 and 451 for 2009, 2010 and 2011, respectively. For this period, the compliance rate to the ESQR was 97%, 94% and 93% for each of the years.



Source: IWK 2012

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

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

Industrial activities generate wastewater that must be treated and disposed of in an environmentally friendly manner. In a 2011 survey conducted by SYABAS, water quality degradation was observed for

some of the water bodies and tributaries that meandered from nearby the industrial areas.

There were 11 industrial areas located near Sungai Langat and its tributaries. The factories ranged from small to large-scale operations, and the types of industry involved were food processing, electrical and electronics, pharmaceuticals, lumber, automotive components, air-conditioning equipment and systems, metal and steel, and paper and stationery.

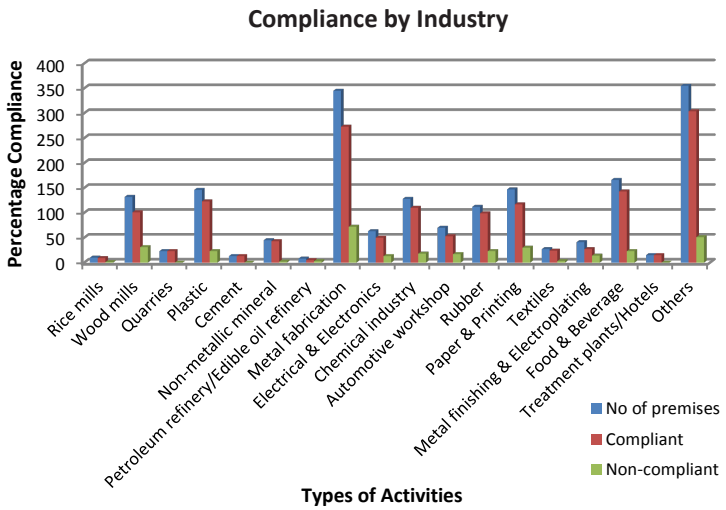
Drains clogged with overgrowth and debris behind a factory
Source: JPBD Selangor 2011

Actions Taken

Various agencies routinely conduct sanitary surveys at designated stations or near water intakes along the river. In the 2011 Salak Tinggi WTP Sanitary Survey carried out by SYABAS, violation of parameters associated with industrial wastes and effluents such as BODs, COD, ammoniacal nitrogen, and mercury were recorded at Sungai Batang Nilai after it merged with the drain that channelled effluents from the Nilai Industrial Park.

In 2011, JAS Selangor conducted 2,133 inspection visits to 1,846 industrial premises. 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

Factors that contributed to non-compliance ranged from poor practices to lack of adequate plants to lack of understanding of regulations.

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

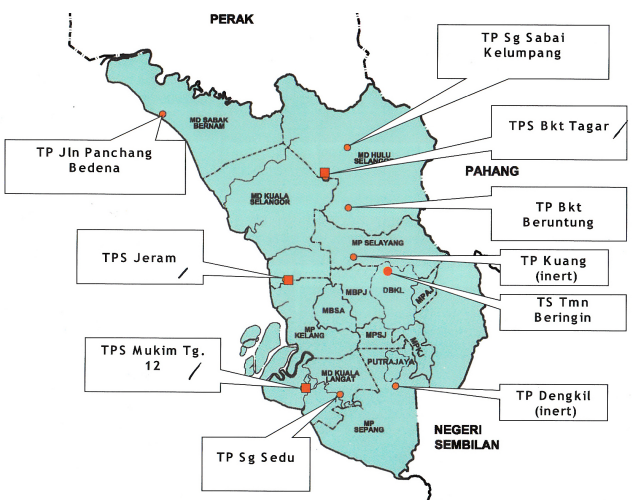
Source: JAS Selangor 2011

SOLID WASTE

Landfills are the oldest form of waste treatment. *Leachate* is produced when rain percolates or passes through waste deposited in a landfill, producing a liquid that has passed through landfilled materials, extracting solutes, suspended solids or any other component of the material through which it passes. Thus, the contents of the contaminant may be related to the nature of the waste deposited.

Generally, leachate is rich in dissolved organic matter (alcohols, acids, and aldehydes), inorganic macro components (sulphate, chloride, iron, aluminium, zinc, and ammonia), heavy metals (Pb, Ni, Cu, and Hg), and organic compounds such as halogenated organics (PCBs and dioxins). The pollution risks from leachate, especially to the water treatment process are due to its high concentration of organic contaminant and ammonia as well as associated pervasive odour.

There are three landfills located within the Sg. Langat river basin: Pajam, TP Tjg Dua Belas, and TP Dengkil. The Sungai Kembong landfill was decommissioned in 2010. The existing landfills are located upstream of the Sungai Semenyih WTP and Bukit Tampoi WTP. These landfills must be managed to prevent contamination of rivers with leachate.



Landfills throughout Selangor
Source: JPSPN 2011

Issues

In 2010, ammoniacal nitrogen in overflow from the Pajam landfill entered the Sg. Semenyih and caused a shutdown of the Semenyih WTP. The overflow was caused by a bund that collapsed during a heavy rain. Ammoniacal nitrogen also seeped out from the landfill at Sg. Kembong, which subsequently closed in 2010.

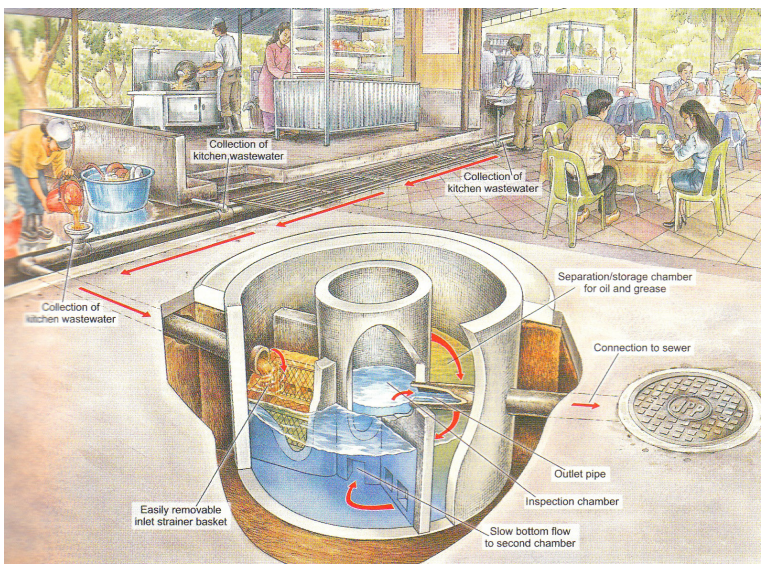
A bund failure at the Pajam landfill causes leachate to seep into the river
Source: LUAS 2012

Actions Taken

The National Solid Waste Management Department (JPSPN) rectified the collapsed bund at the Pajam landfill by erecting a safety enclosure and constructing a leachate treatment plant. A more suitable location for the landfill has been identified at Ladang Tanah Merah, Negeri Sembilan.

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

Some districts in the Sg. Langat basin have invested considerably in solid waste management. In Putrajaya, 392 gross pollutant traps (GPTs) have been approved for 20 precincts, and they are in various stages of construction and handover status. There are various types of GPTs: 119 are conventional, 96 are Ecosol, 92 are Cleansall, and 85 are CDS.



How GPTs Work
Source: Good Practices, JPS, 2008

Illegal Dumping

Solid wastes or litter are often transported by stormwater runoff. However, these items are sometimes illegally dumped directly into the streams or deposited along riverbanks. A SYABAS survey conducted in 2011 showed that household wastes, including plastic bottles, plastic bags, and polystyrene food containers were thrown into the river. It was evident that people were still using waterways as a repository for unwanted things.

This practice poses pollution risks as these wastes disrupt the river flow and contain pollutants that degrade river water quality.

Trash dumped along Sg. Langat near Kg. Jawa in Hulu Langat

SAND MINING

Sand mining and stone quarry mining activities in the Sg. Langat basin caused high turbidity pollution in Sungai Langat and its tributaries. In the Sg. Langat basin, there are 28 sand dredging activities that were approved by LUAS.

No.	Location	Nearby River	Type
2009			
1	Sungai Rasau, Mukim Dengkil	Sg. Rasau	N/A
2	Batu 10, Jalan Cheras to Batu 12 Langat, Mukim Hulu Langat Daerah Hulu Langat (Kg. Sg. Serai)	Sg. Langat	N/A
3	Kg. Bangi Lama to Sg. Bangi Lama, Mukim Kajang, Daerah Hulu Langat	Sg. Semenyih	N/A
4	Sungai Batangsi, Mukim Semenyih, Hulu Langat district	Sg. Langat	N/A
5	Batu 51/2 to Batu 4, Jalan Bangi, Mukim Kajang & Semenyih, Hulu Langat district	Sg. Semenyih	N/A

6	Batu 20 to Batu 15, Mukim Hulu Langat, Hulu Langat district	Sg. Langat	N/A
7	Sg. Labu and Sg. Langat, Mukim Labu, Sepang district, Lokasi 1 (near Kota Warisan)	Sg. Labu	N/A
8	Batu 10 Cheras to Batu 12, Sg. Sekamat, Mukim Cheras, Hulu Langat district	Sg. Langat	N/A
9	Jambatan Kg. Teras Jernang to bridge at UKM (Spot A), Mukim Kajang, Hulu Langat district From Sek. 7 Bandar Baru Bangi to Lebuhraya SILK (Spot B), Mukim Kajang, Hulu Langat district	Sg. Langat	N/A
2010			
1	Sg. Langat and Sg. Semenyih to Sg. Semenyih for 4.5km, Jenderam Hilir	Sg. Semenyih	Sand from river
2	Sungai Langat, Mukim Dengkil, Sepang district Sungai Langat 'A': From Sg. Langat and Sg. Semenyih to Sg. Langat for approximately 1km Sungai Langat 'B': From bridge at Jalan Utama 1, near SM Teknik Sepang to Sg. Langat for approximately 1km	Sg. Langat	Sand from river
3	Sungai Jenderam, Mukim Dengkil, Sepang district Jendaram 'A': From bridge at Kg. Jenderam Hulu to Jln. Jenderam/Salak Tinggi Jenderam 'B': From sempada Jalan Dengkil/ Bangi to bridge	Sg. Jenderam	Sand from river
4	Sungai Labu, Mukim Labu, Sepang district Labu 'C': From bridge at KLIA/Banting to Jalan Pekiling Labu 'D': SYABAS water pipe that cross Sg. Labu to bridge at Kg. Bahar Lanjut	Sg. Labu	Sand from river
5	PN 1681, Lot 17499, Mukim Dengkil, Sepang district	Sg. Labu and Sg. Langat	Sand from mine
6	PT 3362, HSD 701, Mukim Labu, Sepang district	Sg. Labu	Sand from mine
7	Mukim Tanjung Dua Belas, Sepang district	Sg. Labu	Sand from mine
2011			
1	Kg. Bukit Jenuk/Bukit Tampoi (Sg. Langat H), Mukim Dengkil, Sepang district	Sg. Langat	River sand mining
2	Kg. Batu 2, Mukim Dengkil, Sepang district	Sg. Langat	River sand mining
3	Kg. Bukit Jenuk/Bukit Tampoi (Sg. Langat H), Mukim Dengkil, Sepang district	Sg. Langat	River sand mining (pontoon)

4	Kota Warisan, Mukim Dengkil, Sepang district (Labu A)	Sg. Langat	River sand mining (pontoon)
5	Sg. Semenyih	Sg. Semenyih	River sand mining
6	Bridge at Jalan Semenyih to bridge at Jalan Broga, Mukim Semenyih/Jalan Beranang, Hulu Langat district	Sg. Rinching	River sand mining
7	Sek. 3 Bandar Baru Bangi, Mukim Kajang, Hulu Langat district	Sg. Langat	River sand mining
8	WTP 2 Negeri Selangor Intake Plant at Bukit Tampoi	Sg. Langat	River sand mining (pontoon)

Source: LUAS 2012

In the Kuala Langat district, in 2011 there were three approved sand mining locations and two that are illegal. In the same year, high turbidity pollution was experienced in Sg. Langat, which on a few occasions peaked at more than 10,000 NTU and occasionally resulted in operational interruption of the Sg. Langat WTP.

The pollution was traced back to the sand mining and stone quarry activities carried out at Sg. Sub, a nearby tributary of Sg. Langat. The pollution was further exacerbated by heavy rainfall.

In addition to increasing operational costs for water supply companies due to the increase in the amount of coagulants used during the pollution event, the increased suspended solid load in the river posed the risk of increased river siltation, thus altering the natural river hydrology.

According to SYABAS, it is imperative that measures are taken to reduce the amount of pollution in the river by proper mitigation measures such as limiting the issuance of licenses, imposing stringent conditions and requirements such as proper construction and maintenance of retention ponds or silt traps, close monitoring and enforcement on erosion control requirements.

DEVELOPMENT AND EARTHWORKS

One of the issues highlighted in the Integrated River Basin Management Plan for Sg. Langat was land degradation and soil erosion. Land clearing and earthworks initiate surface runoff and erosion problem carry significant levels of suspended solids and minerals into the nearby rivers, particularly during heavy rainfall.

An example is land clearing that was carried out near the natural course of Sg. Long and Sg. Sekamat for housing development which introduced high levels of suspended solids in the river, causing turbidity and requiring enforcement on erosion control.

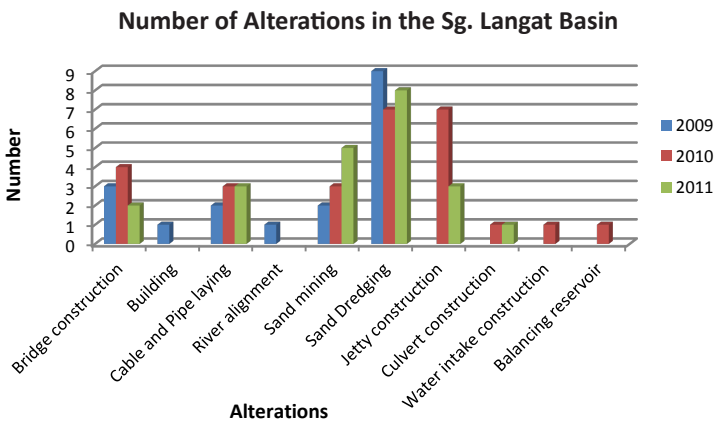
Land cleaning along Sg. Long and Sg. Sekamat
Source: LUAS 2012

In the Sungai Langat Integrated River Basin Management Study, it was noted that erosion occurs in varying intensities in the upstream, midstream and downstream sections of the basin. The midstream section around Kajang and Dengkil experienced massive soil erosion due to land development. Likewise, the downstream sections such as Banting and Telok Datok experienced sedimentation and siltation due to rapid urbanisation and increased runoff. However, there was no severe riverbank erosion due to the low velocity of the river.

Sedimentation in Sg. Langat causes the water to be shallow at the Banting Bridge in Mukim Tanjung Dua Belas, Kuala Langat

ALTERATION OF RESOURCES

Resource alterations refer to any construction or activities that alter or affect existing natural water resources. LUAS licenses resource alteration activities through written approvals. There are 29 activities that are classified as resource conversion activities, including the construction of bridges, highways, jetties, groynes, breakwaters, embankments, walkways, boat ramps, boat moorings, fish racks, fish cultivation ponds and navigation markers. In the years 2009 to 2011, the activity that LUAS has issued the most approvals for the Sg. Langat basin was sand dredging.



Source: LUAS 2012

Another activity that sought approval was jetty construction. Jetty licensing and management for inland navigation fall under the purview of LUAS. At the coast, any jetties outside the basin limits will be licensed and managed by the Port Klang Authority.

LLM is an agency that designs, constructs and maintains highways and related amenities

Other resource alteration activities include three new highways throughout Selangor that were introduced in 2009, 2010 and 2011. They are the KL–Kuala Selangor Expressway (LATAR), South Klang Valley Expressway (SKVE), Sungai Besi–Ulu Klang Expressway (SUKE) and Lebuhraya Kemuning–Shah Alam (LKSA). Among these, SKVE falls within the Sg. Langat basin and has 16 points where they cross over rivers and tributaries. So far, according to Lembaga Lebuhraya Malaysia (LLM), no negative impact as a result of bridge erection was observed.

Another significant alteration of resources was the deepening and widening of several stretches along Sg. Langat to accommodate the passage of the barge transporting scrap iron for the Megasteel Plant. Vessels with draught bigger than 4 m require the approval of LUAS and the Marine Department for passage through the waterways. In some areas, some widening works along stretches of the river in 2007 by Megasteel were carried out, as well as the raising of the Banting Bridge to allow clearance of the passing barge. For the safety of onshore residents as well as barge operators, light beacons are installed at turning points of the river corridor.

Siltation from the upper reaches of the Sg. Langat cause the river mouth to become shallow. In 2011, sand dredging works were carried out around the Bukit Tampoi intake plant to improve the quality of raw water. Jabatan Laut Malaysia has engaged in some dredging work to alleviate the problem, but care is taken to minimise disruption in the fish yield of local fishermen who depend on this activity for their livelihood. Observations have shown that dredging cause fish populations to disappear from the area, although they tend to return four to six months later in groups in greater number.

One of the gates at Banting to control the water level of the river

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. Langat basin, agriculture occupies 60,000 hectares of land, and as shown in the basin's land use distribution, takes up a large percentage of the basin's land.

Commercial plantations for palm oil and rubber as well as fruit and vegetable farming were observed along Sg. Langat and its subcatchments, Sg. Semenyih and Sg. Labu.

The major types of crops cultivated in the basin are shown below.

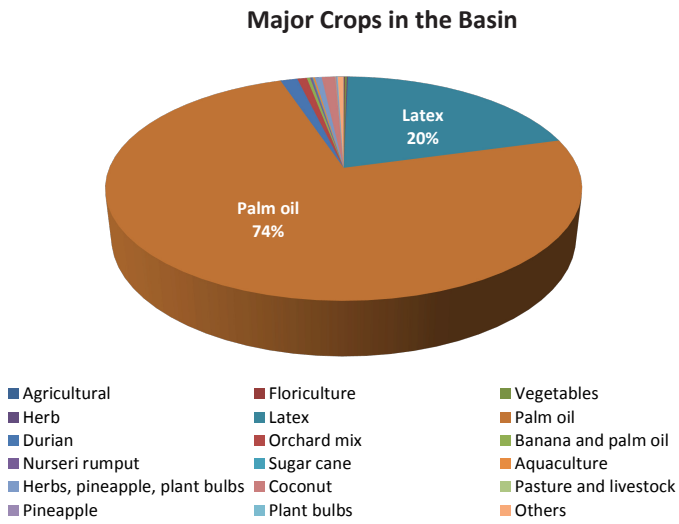
Major Crops in the Basin			
Palm oil	Latex	Durian	Banana
Mixed orchards	Plant bulbs	Herbs	Sugar cane
Pineapple	Coconut	Vegetables	Cultivated grass

Source: Jabatan Pertanian 2012

There are also many other crop types that were cultivated such as jackfruit, rambutan and longan; however, they tended to belong to individual owners on small plots of land. In the pie chart, they constitute the thin slivers of the pie. The predominant crop types in the basin were palm oil at 74% and latex at 20%.

JABATAN PERTANIAN

DOA is an agency for encouraging and monitoring agricultural activities



Common crops grown in the Sg. Langat basin
Source: Jabatan Pertanian 2011

Oil palm plantation alongside mixed crop farms near Kuala Langat

Issues

Fertiliser Run-off. Nitrogen, phosphorus, and potassium that are applied regularly, especially in palm oil plantations, can overstimulate the growth of aquatic plants and algae. This can become an issue as

indiscriminate application of fertilisers and pesticides or herbicides for plant growth or weed control pollute the surface water when runoff, especially after heavy rain, carry these chemicals into nearby streams. This would result in depletion of dissolved oxygen and lead to deterioration of aquatic life.

Irrigation. Another concern, particularly for farmers, is access to water suitable for irrigation during dry seasons. It is dependent on the availability of river flow within the basin. Illegal abstraction of water occurs when small-scale farmers use water piped from inappropriate sources for irrigation. This also results in polluted water being used to grow vegetables for humans. Other sources of water used for irrigation are peat swamps. By itself, the acidic nature of peat water has no adverse effect on crops and produce, but it affects pesticides in that it makes it non-biodegradable. Ground water extraction is an option, but it is deemed expensive for some farmers. There is also concern over the effects of reduction in agricultural areas in favour of urban development.

Sedimentation. Other issues include sedimentation from groundbreaking and earthwork activities for agriculture that enter the waterways.

Irrigation canal leading to palm oil plantation in Kuala Langat

Actions Taken

Control of Pesticide Use. The usage of pesticides is regulated and enforced by the Jabatan Pertanian (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, DOA advises farmers on the proper usage.

To regulate factories and larger agricultural enterprises there is an authority called *Lembaga Racun Mahluk Perosak*. It determines the content of the pesticides and serves as a safety board for factories and small-scale users.

Good Practices. DOA recommends using a vegetative buffer to prevent pesticides to flow into the river. This practice is also one of the key points highlighted in the IRBM Plan. Legumes (*kekacang*) are well suited for this use.

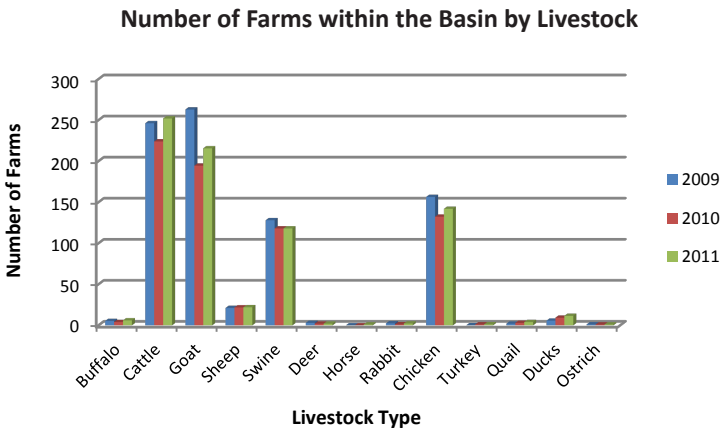
Uncontrolled water runoff from development areas into agricultural land, particularly in the Klang and Sg. Langat, poses a problem for farmers. It is suggested that developments consider drainage systems that do not impinge on agriculture activities. There is also a need for upgrading the drainage system and canals on agriculture land to prevent flooding.

The best practice is to build a holding pond after land clearing, such as at Agrotek at Sungai Batangsi Langat. Gabion walls are also constructed at sites where there is some soil erosion. However, overall there is no enforcement because land and earthworks falls under the land and district offices.

LIVESTOCK FARMING

The main livestock farms in the Sg. Langat basin are cattle and goat, followed by chicken and swine. Other farms in the basin hold buffalo, sheep, deer, horse, rabbit, turkey, quail, duck and ostrich.

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



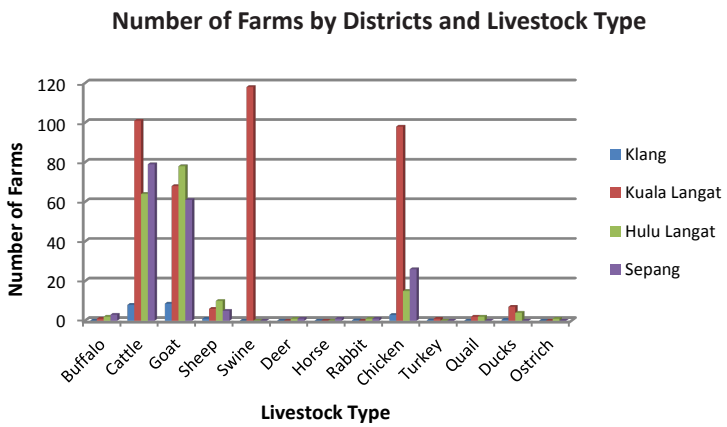
Source: JPV 2012

In terms of actual numbers, there were 244 cattle farms in 2011 followed by 207 goat farms, 139 poultry farms and 118 swine farms throughout the basin.

	2009		2010		2011	
	Farms	Population	Farms	Population	Farms	Population
Buffalo	5	604	4	651	6	686
Cattle	237	11,008	216	10,633	244	11,383
Goat	252	13,936	185	10,201	207	9,913
Sheep	20	1,175	21	1,486	21	1,485
Swine	128	254,141	118	250,055	118	254,349
Deer	3	154	2	19	2	14
Horse	0	0	0	0	1	2
Rabbit	2	15,280	1	30,500	2	28,520
Chicken	153	4,355,075	129	3,620,558	139	9,630,639
Turkey	0	0	1	400	1	400
Quail	2	20,500	3	7,000	4	14,000
Duck	5	6,751	9	2,570	11	5,865
Ostrich	1	250	1	122	1	100
TOTAL	**808**	**4,678,874**	**690**	**3,934,195**	**757**	**9,957,356**

Farms and Population of Livestock in the Sg. Langat Basin
Source: JPV 2012

To give an indication of the physical distribution of the farm locations by districts, the farms were plotted according to districts of Klang, Kuala Langat, Hulu Langat and Sepang. It should be noted that as only a small part of the Klang administrative district falls under the Sg. Langat river basin, a rough estimate of 10% was considered in calculating the number of farms.



Source: DVS 2012

The bar chart shows that although cattle and goat farms were the biggest in terms of numbers, their distribution was widespread among the four districts. With other livestock such as swine or chicken, the farms tended to be concentrated in the Kuala Langat district. Although the distribution is depicted for only the year 2011, the same pattern applies to 2009 and 2010.

In the Hulu Langat districts, cattle and buffalo farms are located in the Bangi area while in the Sepang district, the majority of livestock farms are concentrated in Jenderam Hulu, Dengkil and Kg. Labu Lanjut. Some of these farms have wastewater treatment ponds, but a majority of them do not.

Cattle grazing out in the open near Sg. Langat in the Kuala Langat district

Issues

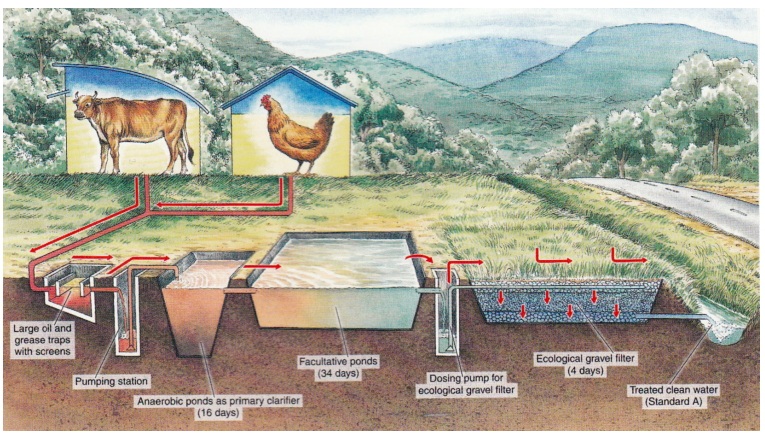
A survey around the basin gave indication that solid and liquid manure and wastewater that contained nitrogen and phosphorus from the livestock farms were discharged directly into the river and contaminated the surface water. The presence of these nutrients could lead to the eutrophication of surface waters, which happens when oxygen is depleted in the rivers.

Actions Taken

Environmental-friendly pollution control. 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.

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

Buffers. JPV recommended more stringent enforcement to make sure that good practices and guidelines were 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 fertiliser, manure, and/or pesticides. The purpose of VFS is to filter and purify runoff as it flows across the filter before discharge into receiving waters.



Source: Best Practices, JPS 2008

AQUACULTURE

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

According to Jabatan Perikanan Negeri Selangor (DOF), there are several types of aquaculture ponds: freshwater, brackish water, freshwater cages, brackish water cages, ex-mining ponds, cement tanks, and shellfish breeding.

In the Kuala Langat district, as of 2010 there are 20 freshwater ponds, 480 brackish water ponds, 40 freshwater cages, and 52 cement tanks, which total 592 ponds.

Types of Aquaculture Cultivation	
Freshwater pond	20
Brackish water pond	480
Freshwater cage	40
Brackish water cage	0
Ex-mining pond	0
Cement tank	52
Cockle breeding	0
Ornamental fish	0
Mussel breeding	0
Total	**592**

Source: Jabatan Perikanan 2012

DOF advocates a treatment pond for each aquaculture site where wastewater from the pond will be directed into the treatment pond before being released back into the river. This is necessary to prevent high levels of BOD from polluting the river.

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 will be expected to change with the gazetting of the new regulations on effluent discharge in 2012.

Fish farming in cages along river
Source: JPBD Selangor

WET MARKETS/RESTAURANTS/FOOD OUTLETS

There are nine wet markets and 169 major eateries (comprising restaurants and food outlets) along the river corridor of Sg. Langat. These establishments are significant in that they contribute directly into the river through direct discharge of effluents and solid waste.

Local Authority	Major Wet Markets	Major Eateries
Majlis Perbandaran Sepang	2	6
Majlis Perbandaran Kajang	3	12
Majlis Daerah Kuala Langat	3	137
Majlis Perbandaran Nilai	0	12
Perbadanan Putrajaya	1	2
Total	**9**	**169**

List of major wet markets and restaurants along the river reserve
Source: JPBD Selangor 2011

Generally, commercial wastes consist of wastes generated from business' premises such as workshops, restaurants, and wet markets. Lack of awareness among premises' owners results in solid wastes such as food wastes, plastics, and papers as well as effluents (sullage, used engine oil, and cooking oil) from these premises to end up in the drainage system that channelled directly into the nearest waterways.

This practice could lead and high organic content and presence oil layer in the river, causing depletion of dissolved oxygen (DO) and objectionable odour in surface water bodies.

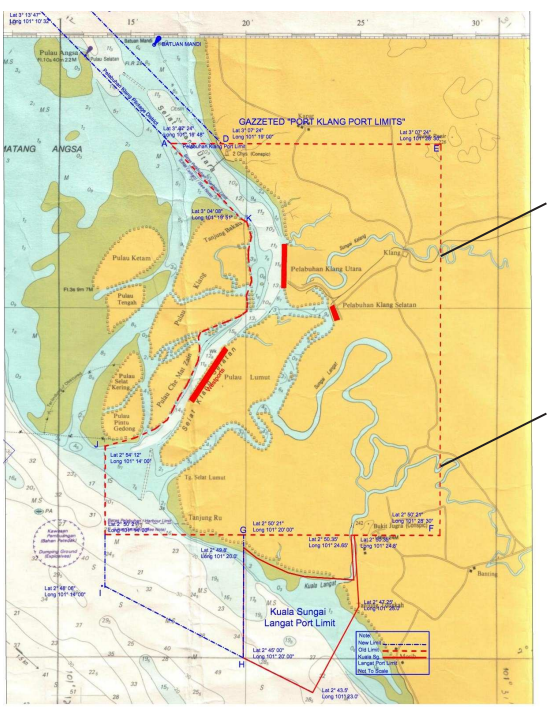
A wet market in Banting with chicken slaughtering facilities

NAVIGATION

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 the Marine Department.

Along the coast there is an area called the *Port Limit*, which designates the area reserved by Jabatan Laut Malaysia (JLM) and the Port Klang Authority. The Port Limit covers the 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. Geographically, the port limit falls under two catchments, Sg. Klang and Sg. Langat river basins.

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



Map of Port Limit in Sg. Langat Basin
Source: LUAS 2011

In terms of river management, 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 Kg. Sawah in the district of Kuala Langat. Anything east of this point is considered 'inland navigation' while all water-related activities west of the point falls under Port Authority or JLM.

However, land activities within the port limit falls under LUAS, and thus all 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 within the Port Limit is off-limits to LUAS.

An 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.

In terms of navigation activity, the Sg. Langat has become a busy place. There are a number of shipyards south of the river, requiring vessels to transport iron scraps and other commodities upstream. One of the major navigation activities involves Megasteel Sdn. Bhd. which was given a license in 2006 to transport 2,000 metric tonnes of scrap metal using barges up the Sg. Langat up to its jetty at Olak Lempit. The Megasteel plant supplies steel to the key industries in the state, thus providing economic benefit. However, in so doing, the operations had to be regulated by LUAS to ensure that environmental degradation of the waterways does not occur and to ensure navigation safety.

A tugboat pulling a barge towards the river mouth on Sg. Langat

Vessel Activities

According to Jabatan Perikanan, the number of fishing vessels registered for Sg. Langat was 487 for year 2009 and 650 for 2010.

Fishing zone	District	Type of vessel	2009	2010
Zone A	Sepang	No engine	0	0
		Outboard engine	137	148
		Onboard engine	20	10
	Kuala Langat	No engine	0	1
		Outboard engine	197	323
		Onboard engine	127	157
Zone B	Sepang	Onboard engine	0	0
	Kuala Langat	Onboard engine	5	11
Zone C	Sepang	Onboard engine	0	0
	Kuala Langat		1	0
Total			**487**	**650**

Number of Registered Fishing Vessels for Sg. Langat Basin in 2010
Source: Jabatan Perikanan 2011

The number of registered fishermen in Sepang showed a small decrease from a total of 211 in 2009 to 208 in 2010. Conversely, in Langat, the figure jumped from 477 fishermen in 2009 to 732 in 2010.

Issues

Navigation activities and fishing boat activities were a major contributor of oil and grease, while groundbreaking and earthwork activities along the coastline and estuary contributed to higher levels of suspended solids. The effects of natural beach erosion also contribute to the turbidity level.

A tugboat going upstream the river near Jugra

Sedimentation from upstream activities causes the river mouth to become shallow. JLM has been engaged in some dredging works although care is taken to avoid disruptions to the local fishing industry.

RECREATION

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

Due to its wealthy natural ecosystem, the Sg. Langat basin has become well-known for ecotourism. Within the basin lies a collection of forest reserve covering an area of 30,833 hectares that includes the Sungai Lalang Forest Reserve, Hulu Langat Forest Reserve, Hulu Semenyih Forest Reserve and Sungai Jeluh Forest Reserve. It is also where both Sungai Langat and Sungai Semenyih dam are located.

Recreational Sites	Location
Bagan Lalang Beach (Sepang Gold Coast)	Sepang
Carey Island	Pulau Carey, Kuala Langat
Gunung Nuang	Pangsoon, Hulu Langat
Nur Lembah Pangsun	Hulu Langat
Paya Indah Wetlands	Dengkil, Sepang
Sungai Batangsi Waterfall	Kajang, Hulu Langat
Sungai Congkak Recreation Resort	Hulu Langat
Sungai Gabai Waterfall	Kajang, Hulu Langat
Sungai Tekala Recreational Park	Semenyih, Hulu Langat

Source: Tourism Selangor 2012

These forest reserves are sites for many local visitors for various activities such as picnicking, trekking, photography and swimming. More adventurous activities such as inner tubing, white water rafting and paragliding are starting to become popular.

Local visitors enjoying a dip at the waterfalls at Sg. Gabai in Hulu Langat

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, diarrhea, 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, diarrhea. Can lead to kidney failure, anemia and dehydration	E-coli bacteria in wastewater

Source: JKNS 2011

There were several outbreaks of leptospirosis in the basin over the past three years.

Disease	District	River	People affected
Typhoid (2009)	Hulu Langat	Sg. Congkak	14 cases of typhoid and 3 cases of salmonella infection
Leptospirosis (2010)	Hulu Langat	Sg. Semungkis	33 human cases tested positive; 11 out of 22 sampling sites along river tested positive

Source: JKNS 2011

The most common sources of pollutants are leachate from landfills, sewage, industrial effluents, among others.

Sources of Pollution
Leachate from landfills that contain heavy metals and agriculture wastes such as pesticides
Sewage: wastewater that flow directly into the river
Industrial effluents from textile, furniture, and latex factories
Illegal sand mining and land use contributes to higher turbidity of the river water
Agricultural activities: fertilisers and soil
Aquaculture and Animal husbandry: waste from animals directly flowing into the river

Source: JKNS 2011

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

Although water treatment plants handle these pollutants, there are some bacteria that cannot be eradicated by standard water treatment. It has been found that protozoas such as *Cryptosproridium* and *Giardia* are resistant to chlorine, the chemical used to treat pollutants. These protozoas are parasites that live in the intestine and cause persistent diarrhea in children and nausea and fatigue. However, this depends on the treatment process, such as the dose of chlorine, coagulant, media filter and water pH.

Currently, the Engineering Services Unit under the Ministry of Health 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.

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.

Issues

The past three years have seen some serious outbreaks. A 2009 typhoid outbreak was due to private riverside resort operators who did not follow specifications for pit latrines and located them closer than the specified 100 m distance from the riverbank. As a result, human waste carrying the salmonella, E. coli and leptospirosis bacteria were found in the waters of Sg. Congkak. In addition, it was found that resort operators also abstract and store the water directly from contaminated parts of the river for use.

Low water pressure in households caused residents in some communities to depend on water from wells, some of which had contained contaminated water. In 2009, there was a typhoid outbreak in Kg. Hj. Palil due to the use of water from contaminated wells as well as other confirmed cases in Gombak. Although the source of infection could not be identified, it was suspected that the cause of the contamination were water activities at Sg. Semungkis and Sg.Langat.

In 2010, two outbreaks of leptospirosis with 199 cases and nine deaths were reported. In the following year in 2011, there were three outbreak of leptospirosis with a total of 473 cases with 19 deaths. The disease was transmitted through contact with river water while swimming in the river, pond or waterfall and engaging in activities such as jungle trekking and camping. Another leptospirosis outbreak in 2010 involved 64 cases occurred through camping activities in Hulu Langat and one outbreak at a campsite in Kuala Langat involving 32 cases and one death.

A typical chalet beside the river at Sg. Congkak, Hulu Langat

Actions Taken

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.

One of the measures that JKNS has taken is to inform the public through hazard warning notice boards describing the risk of infection and preventive actions to be taken.

JKNS warning to riverside visitors of possible water contamination

JKNS has some suggestions for future action, including more enforcement towards polluters of river and other water sources, conducting awareness programs and educate the public on health, and making it compulsory for resorts to be registered and licensed to operate. Many cases of outbreaks involve resorts with public toilet facilities not built to specification and causing spillage.

Other measures call for riverside resort owners to improve or upgrade water treatment and sanitation at recreational areas so that river water is not contaminated for tourists and river users and ensuring proper supply of water to residents in low-pressure water areas to avoid tapping into untested wells.

WATER SUPPLY DISRUPTION

Based on SYABAS' shutdown records since 1997, the Sg. Langat Basin recorded 120 severe raw water pollution incidents leading to plant shutdowns. The only water treatment plants that were not affected were Sungai Pangsoon WTP, Sungai Lolo WTP and Sungai Serai WTP, which were located within the upper part of the catchment area and secluded from active development activities.

In the past, severe raw water pollution involved presence of oil, ammonia, and discolouration as a result of industrial and domestic activities as well as sewerage treatment plants and landfills located within the WTP's water catchment area.

In the case of five shutdown experienced in 2011 at Cheras Batu 11 and Sungai Semenyih, the cause was due to oil present in the raw water. More recently, the high frequency of shutdowns could be brought about by increased residential and industrial development along the river stretches. These developments inevitably contribute to increased sewage and effluent pollution from sewage treatment plants, households, and commercial as well as industrial areas.

According to ABASS, the number of raw water violations due to turbidity at the water treatment plant at Sg. Semenyih was 84 in 2009, 69 in 2010, and 55 in 2011. This was due to sand mining activities and earthworks.

ECOLOGICAL DESTRUCTION

One of the biggest forms of non-point pollution is sedimentation. The most effective way to control sediments entering the rivers is reforestation of the river corridor. The establishment of plant buffer zones along the banks of the Sg. Langat not only reduces the amount of sediments and nutrients entering the river, but also attracts wildlife such as birds to the area. Fruits of the *ficus, eugienia* and *macaranga* plants are important to support bird species such as the pink-necked pigeon, Philippine glossy starling and long-tailed parakeet. The section of the Sg. Langat which is influenced by tide should be planted with the *beramban* tree, which is useful in river bank stabilisation.

It is important to maintain the biodiversity of fishes in the river system. The 40 or so species found in the Sg. Langat basin is extremely low compared to other less disturbed river basins in the country. It is believed that more than 80 species of fish have become locally extinct from Sg. Langat. An example is the giant catfish, *ikan tapah*, which inhabited the rivers of Langat in the 1960s according to local fishermen.

JPNS manages, plans, protects and develops the Permanent Forest Reserve in accordance with national policies

According to Jabatan Perhutanan Negeri Selangor (JPNS), there are several impacts of human activities in the forest on river resources. Some of these include uncontrolled and illegal logging and deforestation that result in the sedimentation of river systems, lowering of water tables that in turn give rise to drying up of river beds and impacting of peat swamp forests, change in microclimatic conditions, degradation of soil, and frequent occurrence of floods.

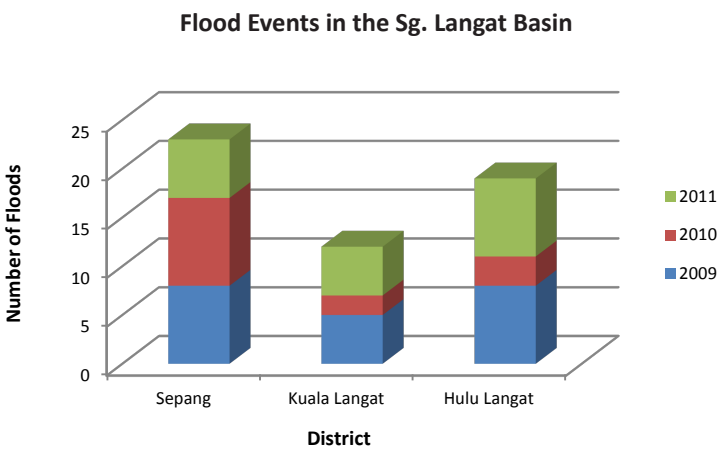
Although forest-based processing mills are located outside the forest, discharge from the mills can flow into the drainage systems and find its way into the waterways. Any discharges are monitored by the respective local authorities and JAS. JPNS can only give advice to the miller.

Still waters near the Semenyih reservoir in the upper Sg. Langat basin

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 54 flood events from 2009 to 2011 in the Sg. Langat Basin. The district that was worst hit for all three years was Sepang at 23 floods, followed by Hulu Langat at 19 and Kuala Langat 12.



Source: Laporan Banjir Tahunan Negeri Selangor and WP for 2009, 2010 and 2011, JPS

In terms of yearly total for flood occurrences, there is not much difference between 2009 (21 occurrences) and 2011 (19 occurrences).

	Sepang	Kuala Langat	Hulu Langat	Total (year)
2009	8	5	8	21
2010	9	2	3	14
2011	6	5	8	19
Total	23	12	19	

Source: Laporan Banjir Tahunan Negeri Selangor and WP 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.
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.

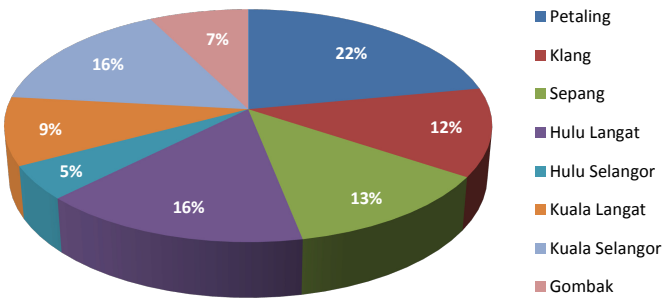
Year	No. of Floods	District	Location
2009	8	Sepang	Taman Desa Indah; Kg. Ginching, Kg. Salak, Kg. Belia Labu Lanjut, Kaw. Pertanian Labu, Kg. Lembah Paya; Kg. Jenderam Hulu, Kg. Lalang, Kg. Ampar Tenang, Kg. Sri Tanjung, Kg. Asli Kelingsing; Kg. Seri Tanjung, Kg. Orang Asli Tasik Selatan, SRK Tamil, Taman Permata Dengkil; Kg. Lembah Paya; Kg. Batu Sepang; Kg. Bagan Lalang
	5	Kuala Langat	Kg. Orang Asli Paya Rumput and Rancangan Tanah Belia Bukit Changgang; Kawasan Kg. Endah and Kanchong Tengah; Kg. Batu Laut, Kg. Kundang and Tjg. Sepat; Kawasan Kampung Batu 9, Kebun Baru and Batu 10, Kebun Baru
	8	Hulu Langat	Kg. Bangi Tambahan; Kg. Tanjung; Kg. Pangsoon, Kg. Kuala Predek, Kg. Dusun Tua, Kg. Padang, Kg. Batu 14, Kg. Bukit Raya Batu 10, Kg. Sungai Serai Batu 11, Kg. Rantau Panjang Bt. 13, Kg. Melayu Batu 10 Jalan Cheras; Batu 18 Hulu Langat; Kg. Bt 18 Mukim Hulu Langat; Kg. Padang Mukim Hulu Langat; Kg. Serai Mukim Hulu Langat; Kg. Batu 15 and 16 Dusun Tua, Mukim Hulu Langat

2010	10	Sepang	Kg. Jenderam Hulu; Kg. Ampar Ternang: Kg. Kelinsing; Jln. Hj. Yusof Kg. Sg. Merab; Hadapan kubur Kg. Sg. Merab; Taman Putra Perdana and road to Taman Kiperk Park Pulau Meranti; Kg. Sg. Merabl Luar; Jalan Meranti 10, Kg. Pulau Meranti; Tanah Pinggir RKT Kg. Limau Manis
	2	Kuala Langat	Kg. Batu 10 Kebun Baru; Kg. Jenjarom
	3	Hulu Langat	Kg. Sg. Serai; Kg. Tasik Permai; Taman Seri Bayu
2011	6	Sepang	Kg. Pengkalan Manggis; Kg. Hulu Teris, Kg. Hulu Chuchoh; Kaw. Perindustrian Ayamas Integrated Poultry Industry; Pasar Pekan Salak; Agroteknologi Sepang; Taman Desa Jenderam
	5	Kuala Langat	Kg. Sg. Judah, Kg. Melayu Pulau Carey; Jalan Sukun Kanchong Darat; Kg. Kelanang, Kanchong Darat, Jalan Raba, Kg. Sg. Nangka Buaya, Kg. Kanchong Tengah, Kg. RTB Bukit Changgang
	8	Hulu Langat	Kg. Sungai Jernih; Kg. Sg. Tekali; Kg. Batu 10 Jln Cheras; Bt. 11 Jalan Langat (Kg. Sg. Serai); Kg. Pandan Dalam; Kg. Pandan Dalam, Kg. Sg. Serai, Kg Sg. Gahal, Pekan Kajang Kg. Sg. Kantan, Kg. Jalan Kelapa, Taman Selamat, Taman Saujana, Taman Jenaris, Kg. Bangi Lama

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%).

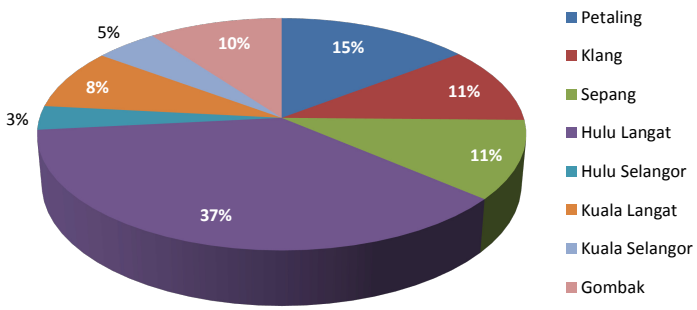
Budget Apportionment for Flood Mitigation Works 2009



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%).

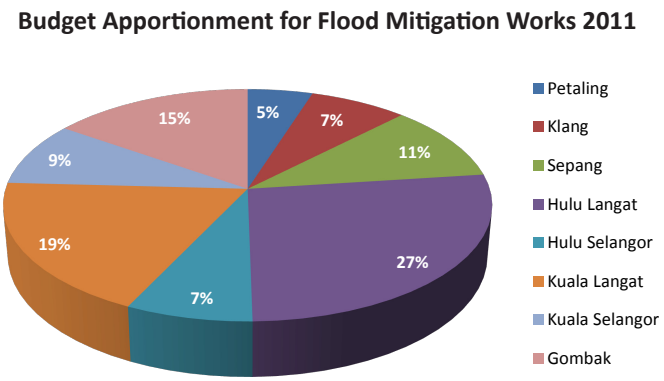
Budget Apportionment for Flood Mitigation Works 2010



Source: Laporan Banjir Tahunan Negeri Selangor for 2010

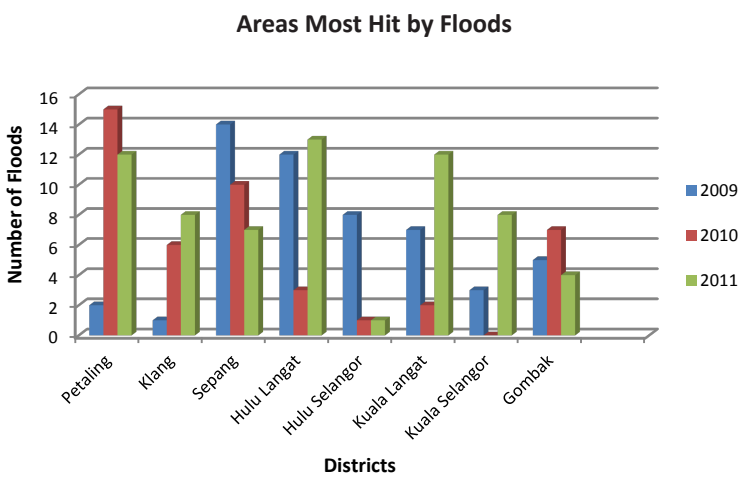
In 2011, the number of major areas affected by floods jumped to 70. Areas with the highest flood impact were in the Petaling district (12), Hulu Langat (13), and Kuala Langat (12). Conversely, the flood mitigation works budget had shrunk to RM10,048,482. The districts with

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



Source: Laporan Banjir Tahunan Negeri Selangor for 2011

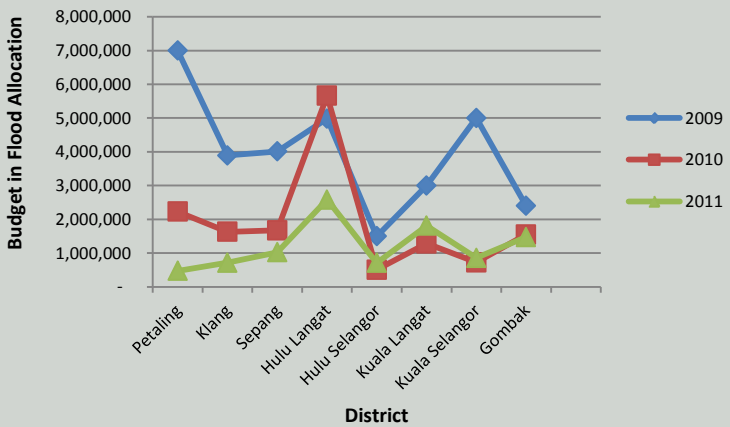
The graph below shows districts that are the most hit with floods over the past 3 years.



FOCUS
No. of Floods

Indicator 7.: Impact – Number of Flood Incidents

In 2009, there were 44 areas within the districts that were stricken by flooding in the Sg. Langat basin, while in 2010 there were 16 areas and in 2011, 41 areas. The number of areas affected by floods fluctuates between 2009 to 2011. Despite the increase in flooding in the stricken areas, in 2011 the budget amount spent on flood mitigation works continued to decrease.



Source: JPS Hydrology 2012

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

COMMERCIAL FISHING

Jabatan Perikanan Malaysia

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. Within the Sg. Langat river basin alone, fish landings have been growing steadily at 4,130 metric tonnes in 2009; 4,270 metric tonnes in 2010; and 3,560 metric tonnes in 2011. Altogether this represents a fish yield of 11,959 metric tonnes within the basin.

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

Fish Species in Sg. Langat			
Alu-alu	Aruan tasek	Bawal hitam	Bawal putih
Bawal selatan	Bawal tambak	Belana/kedera	Beliak mata
Biji nangka	Cermin/sagai/ cupak	Cincaru	Daun baharu
Duri/pulutan	Gelama/ tengkerong	Gerut-gerut	Ikan baja
Jahan/goh	Jebong	Jenahak	Kaci
Kapas laut	Kebasi/selangat	Kepah	Kurau/senohong
Malong	Selar	Senangin	Siakap
Sotong biasa	Sotong katak	Talang	Tamban sisek
Tenggiri	Terubok	Udang harimau	Udang putih

Source: DOF 2012

Ikan Senangin Buis
Source: LKIM

Ikan Kerapu

Actions Taken

According to Jabatan Perikanan Selangor (DOF), most of the species listed above are 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.

To overcome this, the Resources Management Unit under DOF has rolled out an initiative to release specific fish species in certain river areas.

Species	Quantity	Value (RM)	Location
Udang Galah	62,000	3,720	Sg. Langat
Udang Galah	30,000	1,800	Sg. Langat

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

Patin	1,500	975	Sg. Semenyih
Baung	7000	4,900	Sg. Semenyih

Fish Releases in 2011 in the Sg. Langat basin
Source: DOF 2012

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

Indiscriminate dumping of solid waste causes pollution as well hampering efforts to utilise the services of river and coastal waters. Coastal and marine litter is an eyesore and a nuisance for fishing vessels, fish cages, tourism and recreational activities and sea-based aquaculture. On land, indiscriminate dumping of rubbish causes health problems in the community, blocks rivers and drainage systems and is a source of land and water pollution.

The quality of coastal waters of 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.

Paragliders enjoy the view near the coastal waters of Sg. Langat

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. Tekala and Sg. Congkak in the Langat 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.

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. Langat at Pantai Kelanang and Hutan Simpan Sungai Sepang Besar Forest Reserve. 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. Congkak and Sg. Tekali 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 Morib Beach and Kelanang Beach. This programme was important as many of the beaches are popular tourist sites.


Coastal Cleaning

COOKING OIL RECYCLING The Water Resources Conservation Progamme 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 difficult to process.


Cooking Oil Recycling Programme

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

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_3-N	NO_3-N	P	O&G
Category 1 (Rivers)									
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
Category 1 (Lakes)									
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
Category 2									
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
Category 3									
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
Freshwater aquaculture in ponds or cages	Ammoniacal Nitrogen (NH3-N) Biochemical Oxygen Demand (BOD5) at 20oC Total Suspended Solid (TSS) Nitrogen Nitrogen (TN) Phosphorus (TP)	5 mg/l 50 mg/l 100 mg/l 10 mg/l 1 mg/l
Marine shrimp aquaculture in ponds	Ammoniacal Nitrogen (NH3-N) Biochemical Oxygen Demand (BOD5) at 20oC Total Suspended Solid (TSS) Nitrogen Nitrogen (TN) Phosphorus (TP)	5 mg/l 50 mg/l 100 mg/l 10 mg/l 1 mg/l
Development and earthworks	Total Suspended Solid (TSS) Oil and grease	100 mg/l 10 mg/l
Livestock other than pigs	Ammoniacal Nitrogen (NH3-N) Biochemical Oxygen Demand (BOD5) at 20oC Chemical Oxygen Demand (COD) Total Suspended Solid (TSS)	200 mg/l 200 mg/l 500 mg/l 500 mg/l
Swine livestock	Ammoniacal Nitrogen (NH3-N) Biochemical Oxygen Demand (BOD5) at 20oC Chemical Oxygen Demand (COD) Total Suspended Solid (TSS)	200 mg/l 50 mg/l 500 mg/l 100 mg/l
Pets	Ammoniacal Nitrogen (NH3-N) Biochemical Oxygen Demand (BOD5) at 20oC Chemical Oxygen Demand (COD) Total Suspended Solid (TSS)	300 mg/l 50 mg/l 500 mg/l 250 mg/l
Mining-related activities	Total Suspended Solid (TSS) Oil and grease	50 mg/l 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 Alam Sekitar Selangor
Jabatan Perangkaan Selangor
Jabatan Perancangan Bandar dan Desa Selangor
Jabatan Kesihatan Negeri Selangor
Jabatan Perikanan Selangor
Jabatan Perkhidmatan Veterinar Selangor
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Majlis Perbandaran Sepang
Majlis Daerah Kuala Langat
Majlis Perbandaran Nilai
Perbadanan Putrajaya
Majlis Perbandaran Selayang
Majlis Perbandaran Ampang Jaya
Dewan Bandaraya Kuala Lumpur
Majlis Bandaraya Petaling Jaya
Majlis Bandaraya Subang Jaya
Majlis Bandaraya Shah Alam

Majlis Perbandaran Klang
Majlis Daerah Hulu Selangor
Majlis Daerah Kuala Selangor
Majlis Perbandaran Selayang
Jabatan Ketua Pengarah Tanah dan Galian
Pejabat Daerah dan Tanah Kuala Selangor
Pejabat Daerah dan Tanah Gombak
Pejabat Daerah dan Tanah Hulu Selangor
Pejabat Daerah dan Tanah Petaling
Pejabat Daerah dan Tanah Klang
Pejabat Daerah dan Tanah Kuala Langat
Indah Water Konsortium
Jabatan Perkhidmatan Pembentungan
Jabatan Perlindungan Hidupan Liar dan Taman Negara
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Suruhanjaya Perkhidmatan Air Negara
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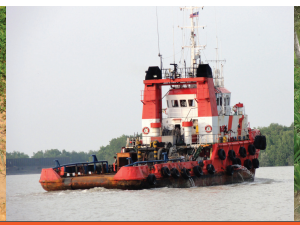


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