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Watershed Management in Malaysia : Conflicts and Solutions

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ABSTRAK

Dalam mengejar mendapatkan status negara maju, perindustrian dan perbandaran di Malaysia memerlukan jumlah air yang banyak. Malangnya, pertumbuhan petempatan serta industri di kawasan-kawasan tadahan bukan sahaja mengancam jumlah air tetapi juga kualitinya. Peningkatan pengurusan dan perancangan sumber air negara diperlukan bagi mengelakkan masalah-masalah di masa hadapan yang mungkin membantutkan pertumbuhan ekonomi serta membahayakan kesihatan penduduk.

ABSTRACT

The industrialization and urbanization of Malaysia as it strives for developed nation status demand large quantities of water. Unfortunately the growth of human settlements as well as industries within watershed areas not only jeopardizes the quantity but the quality of the water. Major revamping of the management and the future planning of the country's water resources are needed to prevent future problems which might curtail economic growth as well as be detrimental to the health of the population.

INTRODUCTION

There is the false belief among the people, educated or otherwise that there will not be a water crisis in a tropical country like Malaysia. The country is rapidly developing, economic growth being an important national goal with the ultimate objective of Malaysia becoming a developed nation by the year 2020. In addition to rapid urbanization and major growth in the manufacturing sector, Malaysia also has extensive operations in plantation and processing a of natural rubber and palm oil. There was a thriving tin mining industry in the country but after the tin market crash in the mid-1980's, it never recovered. The rubber and palm oil related agro-industry represent one of the most significant causes of water pollution mainly because of its wide distribution in the country. Many of the rubber factories and palm oil mills are located close to the headwaters, water catchment areas and a huge amount of pollution is generated in the preparation of the plantations and in the processing of the raw materials. Water pollution severity measured in terms

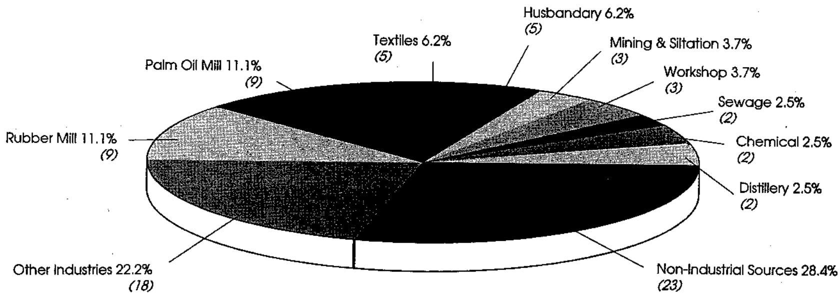

FIGURE 1. Malaysia: sources of water pollution complaints, 1991

of number of complaints received by the Department of Environment (DOE) in 1979, listed effluent discharges from rubber factories and palm oil mills at the top with 54 per cent, followed by industrial effluents with 20 per cent, mining and siltation with per cent, piggery waste with 8 per cent and municipal sewage with 6 per cent. The situation changed in 1991 with the most complaints for non-industrial sources at 28.4 per cent, palm oil and rubber mill at 22.2 per cent and other industries also at 22.2 per cent (Figure 1).

Efforts in protecting our watersheds must be pursued aggressively and the basic philosophy that maintenance of the healthy condition of our watersheds in turn determines our healthy existence should be adopted. Protection strategies include systematic and careful planning and management of long-term development, the identification, establishment and analysis of source-impact relationship, i.e. between residual inputs and water quality resulting therefrom, the establishment and enforcement of proper control actions, and a continuous monitoring of trends in water quality within the system.

IMPACTS OF POLLUTION ON WATER RESOURCES

MAJOR POLLUTANTS AND POLLUTANT SOURCES

More and more rivers in the country have become polluted in the last five years, according the the Department of Environment (DOE), Malaysia. Six rivers, of the 87 major rivers monitored, are considered very polluted. Fortyfour rivers are slightly polluted while 37 are deemed as "clean" (Tables 1 and 2). Domestic sewage, palm oil mills, rubber factories and piggeries are the principal contributors of organic pollutants in Malaysia. DOE Director-General, Dr. Abu Bakar Jaafar said rivers are polluted more by sewage and silt rather than factory wastes.

BOD_5 (Biochemical Oxygen Demand, 5 days, 20 degrees Celcius) is commonly used as a primary indicator of organic pollution. The BOD loads discharged into surface waters from the abovementioned sources were estimated as follows:-

SOURCES	ESTIMATED BOD LOAD	
	LB/DAY	KG/DAY
Domestic Sewage	1,300,000	591,000
Palm Oil Mills	500,000	227,000
Rubber Factories	500,000	227,000
Piggeries	375,000	170,000

Tables 3 and 4 present the main constituents of rubber factory and palm oil wastewater respectively. The figures demonstrate extremely high concentrations of BOD, suspended solids, and several forms of nitrogen as well as low pH values. For comparison, raw sewage contains about 200-300 mg/L BOD.

Tables 5 presents the types of pollutants normally found in wastewaters of some other industries existing in Malaysia. Although the high organic pollution in many cases exerts an appreciable adverse impact on river water quality, especially during low flow periods, however, from the point of view of water treatment for public water supplies, wastes containing toxic metals, organic pesticides and high dissolved solids may be even more troublesome since conventional water treatment systems have a relatively low efficiency for the removal of these pollutants and thus advanced treatment processes will have to be employed.

Tables 6 and 7 present the distribution of industries within and without catchement, areas and the distribution of organic load by industrial sources respectively in 1987. The five per cent figure for manufacturing industries within catchment areas in Table 7 might be higher at the present time as there were many development of industrial estates above water intakes in the last few years.

IMPACT OF POLLUTION

More than a quarter of a centry ago, Aldo Leopold wrote, "Conservation is a state of harmony between men and land". He lamented the fact that despite

TABLE 1. Malaysia: status and trend river water quality, 1986-1991

Index	Clean Rivers	River Water Quality			Net Rate of Change (%)	River Pollution			Polluted Rivers	
		Improved	Not Changing	Deteriorated		Improved	Not Changing	Deteriorated	Slightly Polluted	Seriously Polluted
General	37	17	0	19	-0.66	10	1	40	44	6
800.5 days	65	25	1	39	-0.11	6	1	15	17	5
Ammoniacal Nitrogen	35	14	0	21	-1.95	8	0	44	26	26
Suspended Solids	18	11	0	7	-1.72	18	0	51	17	52

TABLE 2. Malaysia: status of river water qualtiy, 1987-1991

Area	Status	1987				1988				1989				1990				1991			
		WQ1	NH3-N	BOD	SS	WQ1	NH3-N	BOD	SS	WQ1	NH3-N	BOD	SS	WQ1	NH3-N	BOD	SS	WQ1	NH3-N	BOD	SS
Peninsular Malaysia	Clean	11	8	39	19	21	11	39	24	17	7	31	22	19	13	35	20	13	9	33	13
	slightly polluted	39	20	10	14	29	25	11	11	33	27	18	10	27	18	13	6	34	19	15	11
	very polluted	3	25	4	20	3	17	3	18	3	19	4	21	7	22	5	27	6	25	5	29
Sarawak	clean	17	20	20	7	13	21	21	3	17	21	21	9	15	18	20	6	12	18	18	3
	slightly polluted	4	1	1	3	8	0	0	6	4	0	0	2	5	2	0	4	8	2	2	3
	very polluted	0	0	0	11	0	0	0	12	0	0	0	10	0	0	0	10	0	0	0	14
Sabah	Clean	15	17	16	6	14	17	16	6	11	15	12	2	14	12	12	6	12	8	14	2
	slightly polluted	2	0	1	1	3	0	1	0	6	2	5	1	3	5	5	5	2	5	0	3
	very polluted	0	0	0	10	0	0	0	11	0	0	0	14	0	0	0	6	0	1	0	9

Number of River

Note: NH3-N - Ammoniacal Nitrogen BOD -Biochemical Oxygen Dmand SS -Suspended Solids
The Sub-Indexes for NH3-N, Suspended Solids and Biochemical Oxygne Demand are derived by using Mathematical formula
**Source:* Water Quality Criteria and Standards for Malaysia, July 1986

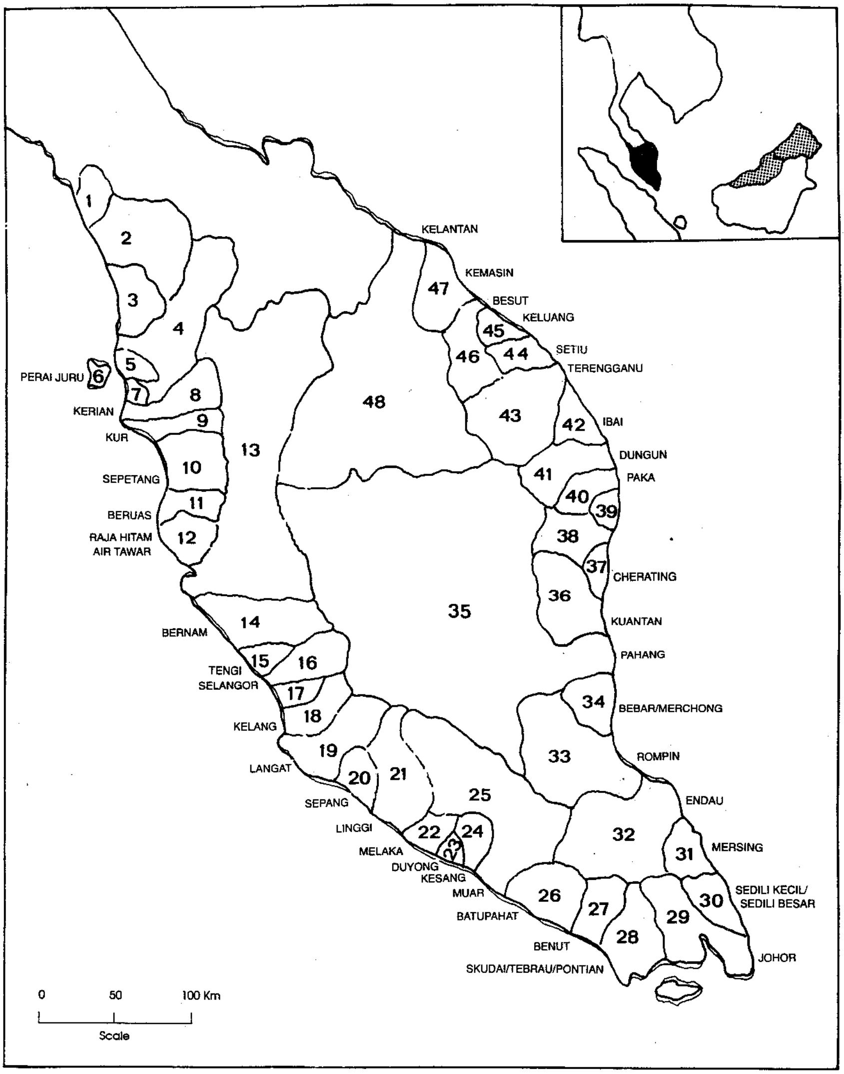

FIGURE 2. Peninsular Malaysia: water quality regions

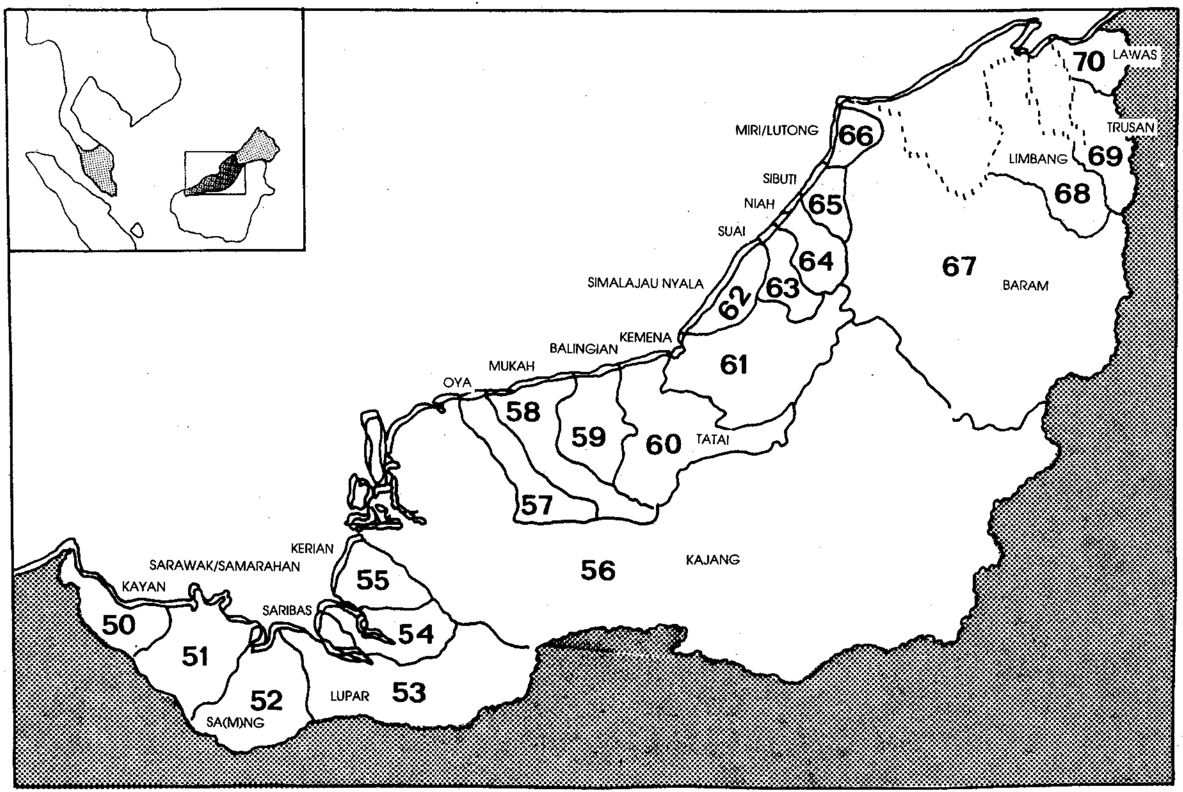

FIGURE 3: Sarawak: water quality region

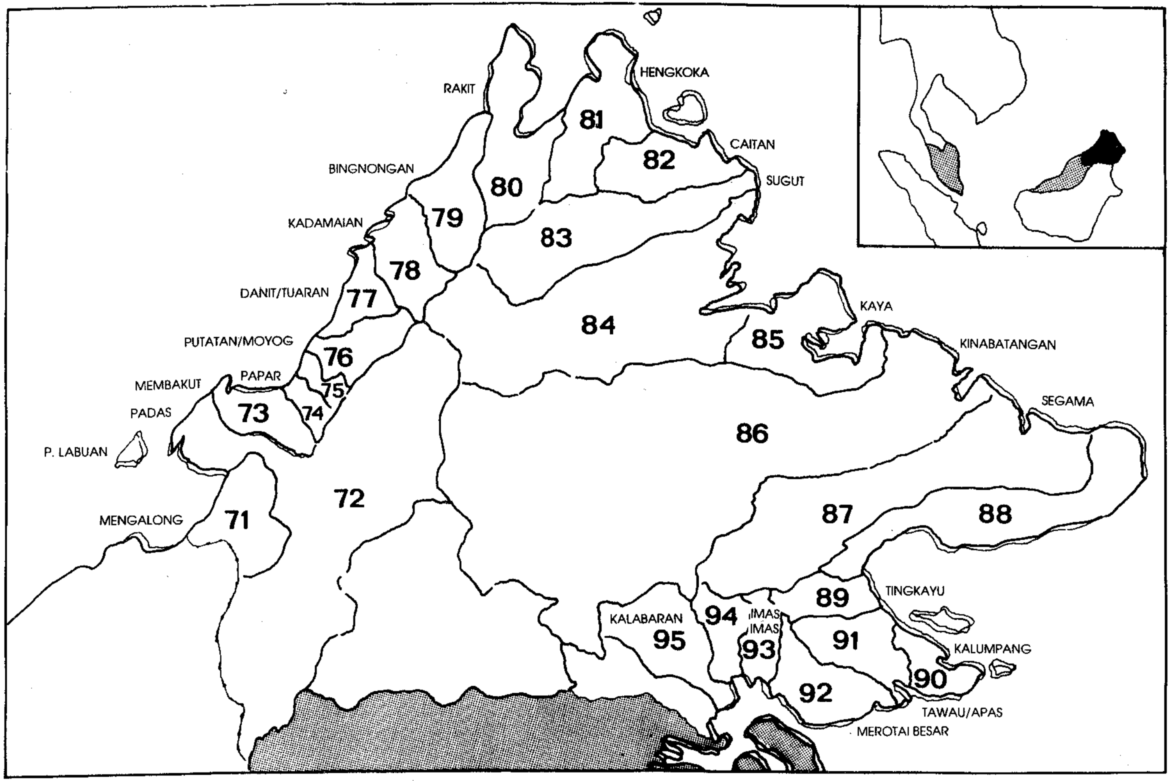

FIGURE 4. Sabah: water quality regions

TABLE 3. Characteristics of rubber processing wastewater type of factory

Parameter	Concenrated Lated	Black Rubber	Ribbed Smoked Sheet
pH	6.3	5.6	4.9
Suspened solids	2,030	540	165
Total solids	7,990	1.410	2,650
COD	13,660	2,140	2,650
BOD	11,830	1,130	2,615
Ammoniacal nitrogen	540	60	10
Albuminoid nitrogen	110	30	100
Total nitrogen	750	100	115

Remarks:
1. All parameters in mg/l except pH in units
2. BOD = biochemical oxygen demand
3. COD = chemical oxygen demand

TABLE 4. Characteristics of palm oil mill wastewater

Parameter	Average Concentration	Range of Concentration
pH	3.7	3.5-4.5
BOD	25,000	20,000-35,000
COD	45,000	30,000-35,000
Ammoniacal nitrogen	30	20-60
Organic nitrogen	600	500-800
Total solids	35,000	30,000-40,000
Suspended solids	25,000	20,000-30,000
Oil and grease	7,000	5,000-10,000

Remarks:
1. All parameters expressed in mg/l except pH in units.

nearly a centry of propaganda worldwide, conservation still proceeded at a snail's pace. He underscored the need for an environemntal ethic. Yet today, the environmental goal must be to harmonize land use practices with society's need for potable water. A land use ethic is needed now more than in Leopold's time. Quality of life and environmental quality should be synonymous in a living society.

Conservation may be considered as a type of "use". Preserved areas such as forest reserves and national parks are primarily developed in areas that are "environmentally" critical, for example, upstream watesheds, estuaries and swamps. The conservation of upstream watersheds for example protects

TABLE 5. Types of pollution problems of wastewater from industries other than rubber and palm oil processing in Malaysia

Industry	Types of Pollutant that mightbe present
Food processing	BOD, SS, pH, oil and grease, temperature
Textile	BOD, SS, sulfide, cadmium, chromium, oil and grease, phenol, detergents, temperature, colour.
Wood preserving	BOD, SS, chromium, copper, mercury, oil and grease, phenol, temperature, colour.
Paper and allied producs	BOD, SS, sulfide, chromium, copper, iron, lead, mercury, nickel, zinc, oil and grease, phenol, chorinated, hydrocarbon, temperature, colour.
Plastics	SS, sulfide, cyanide, oil and grease, phenol, chlorinated hydrocarbon, temperature.
Agricultureal chemicals	SS, sulfide, cyanide, fluoride, arsenic, cadmium, chromium copper, iron, led, manganese, mercury, nickel, zinc, oil and grease, phenol, chlorinated hydrocarbon, pesticides, temperature.

TABLE 6. Malaysia: Distribution of industries according to catchment area 1987

Site Location	Catchment Area for Drinking Water		Total
Type of Industry	Within	Outside	
Prescribed Premises			
Palm Oil Mills	100	150	250
Rubber Factories	89	113	202
Non Precribed Premises			
Manufacturing Industries	283(134)	4463(2037)	4746(2171)
Total	472(323)	4726(2200)	5198(2523)

Notes: Values in ( ) indicates potential water polluting sources

TABLE 7. Malaysia: distribution of organic load by indusrial sources, 1987

Site Location / Type of Industry	Catchment Area for Drinking Water: Within	Catchment Area for Drinking Water: Outside	Total Amount of BOD load discharge into water-courses (tonnes/day)
Prescribed Premises			
Palm Oil Mills	66%	34%	5.16
Rubber Factories	67%	33%	5.09
Non Precribed Premises			
Manufacturing Industries	5%	95%	20.00
Total	26%	74%	30.25

downstream infrastructure from too much or too little water. Indeed, the highest sustained economic return from many areas often occurs by preserving them in their natural state. As a consequence, planning should consider preservation as a viable alternative to development.

A discipline increasingly imposed as populations increase and the standards of living rise, is the combined use of land not only for agriculture, forestry, or urban development, but also for the safe reception and delivery of an unpolluted harvest of fresh water. This philosophy connotes the intermarriage between multiple land use management and maintenance of the quality of life itself.

The need and emphasis on watershed protection and management is not a newly emerged philosophy, but had been a central environmental issue long proposed and universally stressed. In fact it could be traced back to the time of Plato, 400 years B.C., who observed: "There are mountains in Attica which can now keep nothing more than bees, but which were clothed not so very long ago with fine trees, producing timber suitable for roofing the largest building; the roofs hewn from this timber are still in existence and there were also many lofty cultivated trees, while the country still produced bountiful pastures for cattle. The annual supply of rainfall was not then lost, as it is at present, from being allowed to flow over a denuded surface to the sea. It was received by the country in all its abundance, stored in impervious potter's earth, and so was able to discharge the drainage of the hills into the hollows in the forms of springs or rivers with an abundant volume a wide distribution. The shrines that survive to the present day on the sites of extinct water supplies are evidence for the correctness of my present hypothesis".

It is indeed humbling to realise that so clear an analysis was possible by observation and deduction four centuries before the Christian era. It is also alarming that 2000 years later at least half of our human race lives in rapidly growing communities which make no effective provisions for the protection of watersheds.

Watershed management as defined by the International Glossary of Hydrology is "the planned use of drainage basins in accordance with predetermined objectives". Watershed management refers to the planning, implementation, and operation of programs, projects, and practices relating to natural resources and includes the physical, biological, social, economic and institutional aspects of the designated watershed. Hence, like any other system, a watershed system has its inputs and outputs. The watershed itself, with its own physiography, soils, vegetation geology, and institutional arrangements, can be considered as a mechanism for converting inputs and outputs. There are two classes of inputs to the watershed system. One are the natural, generally uncontrollable set of inputs such as precipitation and energy which are random variables. The other set of inputs are the result of man's actions or decisions and include land use, treatments, and practices. In terms of watershed management, man has some control over the use to which the land is put. Each of these land uses, in turn, has treatment or practices that may be applied to produce certain desired results. The outputs from the watershed can be grouped into two categories, namely, economic and environmental. The former represents the items of value produced on the watershed, the agricultural crops, the timber, the livestock and water itself. Environmental outputs are indicators of what has occurred on the watershed with respect to the hydrologic regime. Essentially these are the water and sediment yields and the quality of the water both surface and subsurface.

CONFLICTS IN WATERSHED MANAGEMENT

Most of the industrial growth in Malaysia occurs near the coastal areas. This is quite normal as most the the infrastructural needs such as roads, rail, water and power supplies are easily available. But recently the price of land and the lack of it forced development to move inland, out of the traditional major urban areas into small towns.

The inevitable growth of these small townships also meant possible pollution of wate sources as the more inland the location of a town, the possibility of being within a water catchment area increases.

The irony of the whole situation is that industrial growth and development are somehow dependent on the state government-most states directly or indrectly involved in industrial land development through the State Economic Development Corporation (SEDC); and the industries operating in these industrial estates will be polluting the water sorces for the potable water supply, a major revenue earner over which the states have total control.

This irony or conflicting interests occur to the chagrin of the Federal Government and other related agencies such as the Department of Irrigation Drainage (DID), Department of Environment (DOE) which are also members of the advisory committee to the state governments and they have the data available for decision making purposes.

The tightening of environmental legislation and enforcement especially by requiring environmental impact assessments (EIAs) for development within sensitive areas such as catchment areas should help arrest the conflict between growth and water supply protection but a major snag or kink in the legislation will have to be amended - the power over land matters is under the state according to the National Land Code. There have been instances where a state government has allowed a certain development to go ahead without the EIA being approved yet.

Another legal loophole is that the factory discharging effluents into a water course is only responsible for the concentrations of certain specified parameters but not the volume or the total load. Even if the factory discharges comply with the present standards, the river cannot cope with the total load from the factory as well as other factories in the same industrial areas especially when the rivers are better described only as streams.

There were advocates within and without the government proposing for the major revamp of the water supply management by the setting up of a national water board similar to Great Britain's National Water Authority to take charge of water supply and watershed management. As expected, there was strong opposition from the state government. This apparent conflict between the State and the Federal authorities in handling matters related to watershed management and the environment is a sore point which needs to be resolved for the betterment of future environmental management.

There is a legal clause under the Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979 which has led to much controversy. The clause, under the title of Licence for Contravention of Acceptable Conditions (Appendix III) was labeled as "licence to pollute" by various consumer and environmentalist organizations. The original intent of the contravention licence was good i.e. to help factory owners comply with effluent regulations within a set period of time but whether by intent or accident the licence has been abused. Approval has been given without the factories actually fulfilling the set criteria. Some from large conglomerates applied for the bi-annual licence for many years; some up to 9 years without actually putting any efflort to rectify the problem. Many of the factories given the licence were within water catchment areas. There was a case whereby a car battery factory discharged effluents into a river with two water intakes downstreams with 10 mg/L of lead while the allowable standard specified for 0.01 mg/L. Table 8 and 9 present the contravention licence issued by the types of industry and by justification respectively from 1988 to 1991.

CASE STUDIES

CASE 1: SUNGAI SKUDAI

Sungai Skudai is a small river with a comparatively small watershed in the southern state of Johor Darul Ta'zim. The length of the river is about 47 km from its source in the Yule Catto oil palm estate at Sedenak to its estuary in the Straits of Johore (Selat Tebrau). The river is an important water supply

TABLE 8. Malaysia: contravention licence issued under section 25(1), Environmental Quality Act, 1974

Type of Industry	Year			
	1988	1989	1990	1991
Chemical	9	3	6	9
Food	20	12	7	7
Textile	6	6	5	6
Paper	2	3	4	6
Beverage	10	5	8	5
Electrical Goods	2	1	3	3
Palm Oil Refinery	6	6	4	3
Rubber-based	-	19	9	3
Metal	-	-	-	2
Others	12	18	10	3
Total	75	73	56	47

TABLE 9. Malaysia: contravention licence issued under section 25(1), Environmental Quality Act, 1974

Justification	Year			
	1988	1989	1990	1991
Contruction of Treatment Plant	34	28	28	19
Upgrading of Treatment Plant	8	11	17	15
Lack of Treatment Technology	4	4	2	3
Discharge into Central Sewerage Plant	9	6	4	2
Lack of Land	10	5	1	-
Others	5	7	4	8
Total	75	73	56	47

source for the Public Utilities Board, Singapore (PUB), with the water intake and treatment plant beside the Senai Highway before the Skudai township. The maximum capacity of the treatment plan is about 40 mgd (million gallons per day) but is usually processes only between 10 to 20 mgd. About 60 per cent of the finished water is for Johor Bharu residents. PUB has been regularly complaining about the increasing deterioration of the raw water quality in the form of ammoniacal nitrogen (AN) and phenolic compounds.

The pollution problem of Sungai Skudai is tremendous because the watershed is an important developing area for Johore with a population of about 60,000 in five major townships and residential areas (Kulai, Kulai Besar, Kulai Baru, Saleng and Senai), an industrial are (Senai Industrial Estate), an open solid waste dump, pig-farms and mixed single industries. With the recent economic upswing the area is set for rapid development as it will be receiving the growth spill over from the other surburbia surrounding Johor Bahru. The growth, if not in the industrial sector, tends to be in the form of support services such as residential areas.

As in the case of most small townships in the country, the preferred method of sewage treatment in the Sungai Skudai watershed is by using septic and Imhoff tanks with a sprinkling of other methods such as oxidation ponds and activated sludge. The infamous "hanging" latrines built over drains or streams are also used by some residents. The three pig farms in the area do not have proper treatment facilities except for settling ponds.

High ammoniacal nitrogen in the river especially during dry spells is unavoidable since major sources are from the semi-treated sewage, pig-wastes and a number of rubber and palm oil factories. The results of the 24-hour monitoring at the PUB water intake show a relatively high amount of ammoniacal nitrogen especially at 12:40 a.m. on November 10, 1989 even though it was the rainy season. Phenolic compounds can be emanated from organic pollution similar to the sources of pollution for ammoniacal nitrogen especially from palm oil mills but direct pollution from a few textile industries and an optical lens grinding factory is also possible.

Both ammoniacal nitrogen and phenolic compounds can cause water treatment problems. Ammoniacal nitrogen forms monochloramines and dichloramines with chlorine, depriving the finished water of the necessary residual chlorine while phenolics form chlorophenols also with chlorine, causing noxious smelling drinking water.

CASE 2: SUNGAI LANGAT

Sungai Langat is a very important watershed which supplies water to most of the Klang Valley where Kuala Lumpur is situated. There are two major dams for controlling the water flow of the river. These are the Langat and the Semenyih dams. On the Sungai Langat proper there are three major water intakes and one on Sungai Semenyih, the main tributary of Sungai Langat before its confluence with Sungai Langat. The last one is the biggest. Smaller intakes and plants are also operational on the smaller tributaries of Sungai Langat including the one on Sungai Batang Nilai near Salak.

While the upper reaches of Sungai Semenyih and Sungai Langat above the dams are forested, unpopulated and unpolluted areas, the watershed below the dams onwards to the water intake points are with population. There are traditional villages with rubber and fruit plantations, small towns plus several industrial estates. Within the Sungai Langat proper watershed there are industrial areas at the ninth mile Cheras, Inch Kenneth/Balakong Industrial Estate, Kajang Industrial Areas and Bangi Industrial Area.

Meanwhile the Sungai Semenyih water catchment has Semenyih and Beranang Industrial Estates as well as the fast-growing Nilai Industrial Estate in the neighboring state of Negeri Sembilan. There are also numerous individual factories manufacturing a variety of products from both watersheds.

FUTURE CONFLICTS

An interesting development that might lead to future interstate conflicts is the management of water resources of rivers that cross state boundries. Rivers polluted by a factory or an industrial estate in one state could be used by another for potable water supply. This situation has occurred in the Sungai Langat water catchment area in the state of Selangor as mentioned above where three water treatment plants are being jeopardized by the pollution caused by the housing and industrial development around Nilai.

Different emphasis of how water resources from the same river which crosses state boundaries should be used also might bring about future conflicts similar to the conflict on the management of the mighty Colorado between the states of Arizona, Colorado and California. For example, the Muar river which starts in Negeri Sembilan, flows mostly through Johor which not only abstracts a large amount of the water for potable supply but also have a long term agreement to sell raw water from Sungai Muar via a pipeline to the water hungry state of Melaka. Meanwhile, the State Government of Negeri Sembilan is planning to build dams in upper Muar to cater for their own needs which might draw protests from Johore as dam constructions might decrease water supply downstream.

CONCLUSION

The rate of industrial growth in Malaysia in the last two decades has been tremendously fast and the continous rapid social, physical and economic development has imposed a huge strain on the water resources - one of the basic infrastructural necessities. The amount of water resources of the country economically viable for development is rather limited. Ironically these limited water resources are indiscrimately subjected to pollution from domestic and industrial wastes. This has resulted in the degradation of raw water quality causing an increase in treatment costs as well as possible lowering of finished water quality for public and industrial consumption. Unless drastic steps are taken to confront and solve these critical problems serous depletion and continous lowering of the quality of our water supply would be inevitable.

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Appendix I

Third Schedule

Environmental Quality Act, 1974

Environmental Qualtiy (Sewage and Industrial Effluents) Regulations, 1979

[(Regulation 8(1), 8(2), 8(3)]

Parameter Limis of Effluents of Standards A and D

	Parameter	*Unit*	*Standard*	
			A	*B*
	(1)	(2)	(3)	(4)
(i)	Temperature	°C	40	40
(ii)	pH Value	-	40	40
(iii)	BOD_5 at 20°C	mg/1	20	50
(iv)	COD	mg/1	50	100
(v)	Suspended Solids	mg/1	50	100
(iv)	Mercury	mg/1	0.005	0.05
(vii)	Cadmium	mg/1	0.01	0.02
(viii)	Chromium, Hexavalent	mg/1	0.05	0.05
(ix)	Arsenic	mg/1	0.05	0.10
(x)	Cyanide	mg/1	0.05	0.10
(xi)	Lead	mg/1	0.10	0.5
(xii)	Chromium, Trivalent	mg/1	0.20	1.0
(xiii)	Copper	mg/1	0.20	1.0
(xiv)	Manganese	mg/1	0.20	1.0
(xv)	Nickel	mg/1	0.20	1.0
(xvi)	Tin	mg/1	0.20	1.0

Appendix 1 (*Continuation*)

(xvii)	Zine	mg/1	1.0	1.0
(xviii)	Boron	mg/1	1.0	4.0
(xix)	Iron (Fe)	mg/1	1.0	5.0
(xx)	Phenol	mg/1	0.001	1.0
(xxi)	Free Chlorine	mg/1	1.0	2.0
(xxii)	Sulphide	mg/1	0.50	0.50
(xxiii)	Oil and Grease	mg/1	Not Detectable	10.0

Appendix II

Water Quality Classification

Class	Uses
I	Conservation of natural environment Water supply I - practically no treatment necessary (except by disinfection or boiling only) Fishery I - very sensitive aquatic species
IIA	Water supply II - conventional treatment required Fishery II - sensitive aquatic species
IIB	Recreational use with body contact
III	Water supply III - extensive treatment required Fishery III - common, of economic value, and tolerant species Livestock drinking
IV	Irrigation
V	None of the above

Class I represents water bodies of excellent quality. Standards are set for the conservation of natural environment in its undisturbed states. Water bodies such as those in the national park areas, fountain-heads, and in high-land and uninhabited areas come under this category where strictly no discharge of any kind is permitted. Water bodies in this category meet the most stringent requirements ion human health and aquatic life protection.

Class IIA represents water bodies of good quality, most axisting raw water supply sources come under this category. In pratice, no body-contact activity is allowed in these waters for the prevention of transmission of probable human pathogens. There is a need to introduce another class for water bodies not used for water supply butof a need to introduce another class for water bodies not used for water supply but of similar quality which may be referred to as for class IIB. The determination of Class IIB standards is based on criteria for recreational use and protection of sensitive aquatic species.

Class III is defined with the primary objective of protecting common and moderately tolerant aquatic species of economic value. Water under this classification may be used for water supply with extensive/advanced treatment. This class of water is also defined to suit livestock drinking needs.

Class IV defines water quality required for major agricultural irrigation activities which may not cover minor applications to sensitive crops.

Class V represents other water which do not meet any of the above uses.

Appendix III

Environmental Quality

(Sewage and Indusrial Effluents)

Regulations, 1979

Licence for Contravention of Acceptable Conditons

Acceptable conditons which may be contravened

(1) In accordance with the provisions of section 25(1) of the Act, application for a licence may be made for the purposes of the contravention of acceptable conditions of effluent discharge specified in regulation 8.

(2) An application for a licence shall be made in accordance with the procedures specified in the Environmental Quality (Licensing) Regulations, 1977.

(3) The Director-General may refuse to grant the application for a licence if he is satisied that the granting of application for such a licence is likely to cause a worsening of condition in the inland waters of couse pollution in any other segment or element of the environment.

(4) Without prejudice to the generality of paragraph (3) of this regulation, the Director-General may grant the application for a licence if he is satisfied that:-

- (a) there is no known practicabel means of conrol to enable compliance with the acceptable conditions; or
- (b) the estimated cost to be incurred for compliace will be prohibitive having regard to the nature and size of the industry, trade, or process being carried out in the premises discharging the effluent; or
- (c) the design and construction of any treatment plant or other control equipment and their commissioning require a longer period than the period for compliance with these Regulations; or
- (d) the imposition of the acceptable conditions as prescribed may result in circumstances which, in his opinion and having regard to all factors, are not reasonably or are contrary to the intent and spirit of the Act; or
- (c) a sewerage system is to be provided and the effluent is permitted to be admitted into the sewarage system.

(5) For the purpose of subparagraph (4)(e), in imposing conditons on a licence limiting the parameters of effluent to be discharged, the Director-General shall be guided-

- (a) by the parameter limits of Standard B in respect of the discharge into any inland waters specified in regulation 8(1)(a); or
- (b) by the parameter limits specified in the Sixth Schedule in respect of the discharge into any other inland waters.

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