

A Critical Review of Malaysia's Accomplishment on Water Resources Management Under AGENDA 21

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ABSTRACT

Malaysia is a signatory of the Rio Summit in 1992 and is bound by agreement to satisfy all the requirements of country-wise sustainable management of water resources. While many steps have been taken there is still much to do before Malaysia completely satisfies all the Agenda 21 requirements under Chapter 18. There is the absence of a clear-cut National Water Resources Policy to guide the sustainable development of water resources and water sector strategies. While laws for the protection and conservation of water resources are adequate, poor enforcement is a major problem. Malaysia has also not explored the development of new and alternative sources of water-supply but continue to rely on rivers which are increasingly polluted. Public participation in water resources management is poor, largely due to reluctance of the water authorities to use the public and also public apathy. Decision-making in water resources planning and management is still largely a Top-Down approach. Rapid unplanned urban development that decimated forests have led to flooding. Finally, climate change such as El Nino and La Nina is another major problem. Privatisation of the water industry has not been as successful as it ought to be, mostly due to the lack of meritocracy, transparency, accountability and expertise.

ABSTRAK

Malaysia menandatangani Sidang Kemuncak Bumi pada 1992 dan terikat dengan persetujuan untuk memenuhi keperluan pengurusan sumber air secara berterusan. Walaupun banyak langkah yang telah diambil, namun masih banyak lagi yang perlu dilakukan sebelum Malaysia benar-benar dapat memenuhi kesemua keperluan Bab 18, Agenda 21. Kini masih tidak terdapat suatu Dasar Sumber Air Kebangsaan yang jelas untuk memandu pembangunan berterusan sumber air dan strategi sektor air. Walaupun undang-undang untuk perlindungan dan pemuliharaan sumber air agak lengkap, penguatkuasaan masih menjadi masalah. Malaysia juga masih belum menerokai sumber bekalan air alternatif atau yang baru dan masih bergantung pada sungai yang kini semakin tercemar. Penglibatan orang awam juga masih kurang mungkin

kerana keengganan pihak berkuasa air untuk melibatkan mereka ataupun sikap masyarakat yang tidak ambil peduli. Pembuatan keputusan dalam perancangan dan pengurusan sumber air masih menggunakan pendekatan dari atas ke bawah. Pembangunan Bandar yang pesat dan tidak dirancang dan mengurangkan hutan telah menyebabkan banjir. Tambahan pula perubahan iklim seperti El Nino danb La Nina juga merupakan satu lagi masalah besar. Penswastan industri air telah tidak begitu berjaya kerana kebanyakannya disebabkan kurangnya meritokrasi, ketelusan, akauntabiliti dan kepakaran.

INTRODUCTION

The beginning of the 21st Century is straddled with enormous environmental problems of which water shortages is one of the most serious. According to the United Nations and the World Watch Institute, water is expected to be the central issue of this century. Currently, the United Nations estimates that 1.2 billion people drink unclean water, and about 2.5 billion lack proper sanitation. Another 5 million die annually from water-related diseases such as cholera and dysentery and all over the world, water is depleted much faster than it can be replenished by nature (Montaigne 2002). The United Nations further predicts that 2.7 billion people would face severe water shortages by 2025 if consumption continues at current rates. Though almost all countries in the world are under some degree of water stress at some time and space, over-abstraction and wastage are causing more than half of the world's countries being constantly under severe water stress. For example, the Hwang Ho in China has failed to reach the sea in recent years because of over-abstraction upstream. Elsewhere, the Nile, Ganges, Colorado and Rio Grande rivers had similar problems in recent years. In Central Asia, the Aral Sea has shrunk by half and is fast disappearing. Most alarmingly, however, is the fear that the fight for water (between nations) may escalate into war. At the present moment, many countries with shared river basins are already fighting/disputing over the limited water resources – e.g. the Jordan River Basin, the Mekong Basin, the Lower Ganges, the Nile, etc. (Amery & Wolf 2000). Historically, some water wars have been fought bringing loss of life, untold damages and misery (Cech 2002).

The Rio Summit in 1992 produced a document that clearly outlines the vital importance of water resources for humanity and ecosystem. The document outlines what countries (i.e. governments) must do/implement in order that water resources can be sustained in the future as water is expected to become increasingly polluted and scarce (Clark 1991; Chan

1997). However, the document does not emphasise on the role of Non Governmental Organisations (NGOs) and the public. There remains also many areas in which the document is lacking. Recycling of water is one area that I find woefully lacking in the document. As water resources get depleted and polluted, many societies are faced with the grim prospect of water rationing, polluted water, and even no water for long spells during the dry season. Hence, it is necessary to put greater emphasis on the 3Rs – i.e. recycle, re-use and reduce available water. This is all the more important as the amount of water is finite (in actual fact the amount is getting smaller due to pollution, destruction of catchments, competing interests and other reasons) but population is ever growing. On the average, water demand doubles about every two decades or so, but the amount of water on earth remains the same. Hence, it is obvious that the amount of water available per capita will decrease in the future. In other words, more people would have to share the same amount of water. If water pollution is considered, the amount of available water becomes even less. Hence, in the near future, recycling would not be an option anymore but a must. Many water-poor countries in Europe are doing it and Singapore is now considering this option. The document also does not give enough attention to demand management. However, in order for the document to work, government plans need to be supported by the masses. There is no use increasing water supply (supply management) via building dams and treatment plants if the public continues to waste and abuse water. Effective water resources management necessitates cooperation from government, industry and public. Demand management, i.e. reducing and managing one's demand for water is vital for effective water management.

It was reported that Malaysia was happy with the outcome of the Johannesburg global summit in September 2002 (Rio +10) (The Star 2002). Deputy Prime Minister Datuk Seri Abdullah Ahmad Badawi reported that the Malaysian delegates had actively participated in the 10-day talks to ensure that the meeting addressed issues of importance to the country. The Deputy Prime Minister reiterated that what Malaysia has achieved was good. However, Malaysia still has targets to achieve for water and sanitation to the further implementation of Agenda 21 specifically, and sustainable development, generally. He also confirmed that Malaysia supported the Kyoto Protocol on climate change and had ratified the treaty in New York on 4th September 2002.

MALAYSIA'S ACCOMPLISHMENT ON WATER MANAGEMENT

In Malaysia, water is seen as an enigma, manifesting itself in both extremes as floods and droughts (Chan 2002a). Hence, any attempt to manage water resources will have to take in account both the management of excess water (floods) and too little water (droughts). Malaysia is on the verge of becoming a developed and industrialized country and much has been achieved in all fields, including water resources management. However, water problems are not completely solved as they continue to resurface from time to time. Malaysia's water management strategy is a legacy from our colonial past. It is largely based on using engineering structures to increase water supply. Hence, inevitably it is based on a top-down approach focusing on supply management, an outdated approach that has outstretched the limits of water supply of most river basins in the country (Keizrul 2002). Ineffective management, leakage, wastage, ineffective privatisation, public apathy and other reasons are major water issues. Increasingly, the government is encouraging a more comprehensive approach balancing both supply and demand management whereby civil society, NGOs and local communities are allowed to play greater roles in "smart partnerships" with the government in water management (demand management) and other water issues. However, much more is needed than encouragement. Political will and stamina is needed to pursue this course of action. The government also needs to increase public consultation and participation to ensure transparency and accountability in the water industry, particularly in the area of privatization of the water industry. Partnerships between government and industry (e.g. in water recycling and water management systems) are also vital for sustainable development of water resources. Industry-NGO partnerships are hitherto poorly developed and much can be done in this area. The following sections present a critical review of Malaysia's accomplishments of the Rio document, especially pertaining to Agenda 21 on water resources management.

Background to Water Management in Malaysia

Malaysia recognizes the vital importance of water resources and its role in the development of the country. Though water resources are abundant (theoretically) in Malaysia, variation over space and time has rendered problems of excess and scarcity at various times and space. Hence, various attempts have been taken to ensure that water resources can be sustained in the future (Chan 2002a). Malaysia receives an average rainfall of 3000 mm per annum and this is translated into 566 billion cubic

metres of surface water flowing in more than 150 river systems. Because of copious rainfall, the country is often inundated with excess water culminating in severe floods (Chan 1995). Hence, there is a general misconception amongst policy makers that we have too much water and the problem is not with drought but floods. There is also a general perception that Malaysia's water resource base is "inexhaustible" (Chan 2002a). Certainly, the majority of those in charge are of the opinion that Malaysia has no water shortage problems (until the water crises that hit Melaka in 1991 and again in 2002, and Selangor, Kuala Lumpur and Penang in 1998). Based on abundant rainfall, a person in Malaysia has access to more than 20 times the water available to someone in Yemen! Yet, ignorance amongst policy makers with regard to total available water resources has contributed to water crises in many parts of the country. Another major problem is that of the high domestic water usage per capita. In the 1970s, Malaysians use only about less than 200 litres of water per capita per day (LPD). This figure then increased to about 250 LPD in the 1980s and then to more than 300 LPD now. In urban areas, it has been estimated that the average person uses about 500 LPD (Renganathan 2000). If we consider the fact that the International Standard for water use recommended by the United Nations is 200 LPD, then Malaysians now are guilty of wasting 100 LPD. Malaysians living in the urban areas waste more than 300 LPD, i.e. an amount that can be used to sustain six persons in Sudan. In Malaysia, most of the wasted water goes to flushing toilets, bathing, washing cars, clothes, floors, watering plants (gardening) and other unnecessary chores - i.e. activities which we can reduce and hence reduce water use. As a comparison, an average Indian (in India) uses only 100 LPD and a Yemeni uses even less, about 50 LPD. Hence, reduction of usage is a key to water saving amongst Malaysians.

In Malaysia, water resources are managed as a State resource though the federal government passes the legislation and sets most of the regulations. Hence, "water" is a State matter, and water encompasses water bodies such as rivers, lakes, streams, and groundwater. In Malaysia, Though water is a state matter, it is not exclusively a matter within the sole jurisdiction of the States as the Federal Government has specific powers. The Federal Government has jurisdiction in the case of national water supplies works, as well as rivers and canals which cut across state borders, except those which are regulated by an agreement between the States concerned. The Federal Government also has control over other aspects of water resource utilisation such as hydropower generation, navigation within ports, marine fisheries and mining. The Malaysian Parliament has powers to make laws relating to water resources. However, federal power to make such laws, is subject to approval by the State Legislature

concerned. Water rates are considered a source of revenue to the States. Water related laws enacted by the Federal Government include the Waters Act, Land Conservation Act, Fisheries Act, Street, Drainage and Building Act, Town and Country Planning Act, Local Government Act and National Land Code. However, the bottom line is that the State Governments, by virtue of the fact that water and related matters lie within their jurisdiction, are in a better position to control and regulate such matters. For example, the State of Selangor in has enacted the Selangor Waters Management Enactment (SWMAE) that establishes the Selangor Waters Management Authority (SWMA). SWMA is expected to regulate and manage all water resources in the state of Selangor on a sustainable basis (<http://www.agrolink.moa.my/did/river/stormwater>).

In recent decades, the Malaysian Government has embarked upon a privatization campaign that has seen the privatization of essential services. Some, such as electricity and telecommunications, have been successful. Though the privatization of the Penang Water Supply Corporation Sdn Bhd appears to be successful, some such as Indah Water Konsortium, the national sewage water treatment company and the Kelantan Water Company have not been profitable. Currently, six states are served by Water Supply Companies (privatized), four states by Water Supply Board (corporatized), three states by Water Supply Department (under State Governments) and four states by the Public Works Department (Federal Body) (The Malaysian Water Association 2002: 18). As water is a vital resource, the Government must ensure that it still has an important say in its management, tariffs, quality, service, etc.

Integrated Water Resources Development and Management

Malaysia is one country that is plagued by a Federal-State as well as inter-state dilemma. This is because states have the power over land and water although the federal government rules the country (and have influence over state governments). Hence, states are wary of losing their rights over water to the federal government or other states. This is the case when river basins cut across state boundaries. Hence, each state develops its river basins independently, often resulting in conflicting developments. Consequently, integrated river basin management (incorporating integrated water resources management) is lacking. This due to a number of reasons: (i) Many river basins cut across states boundaries and one state's development may affect another's. Yet, each state pursues its own development agenda without the need to consult other states, often resulting in adverse effects on adjacent states (for example logging in a hilly area in one state may give rise to sedimentation and flooding downstream in an adjacent state; (ii) There

are too many agencies and government departments (both at the federal and state levels) involved in water resources, some directly and some indirectly (Table 1); (iii) There is no central agency to manage and arbitrate in inter-state water disputes until the National Water Resources Council (NWRC) came into effect in 1998 (after the 1998 water crisis). However, the NWRC is a federal body and since under the constitution water is a state matter, many states are suspicious that the NWRC may undermine or erode their hold over their water resources.

Table 1. Agencies involved with water management in Malaysia

Agency	Area of Responsibility
DID	Responsible for implementation of water resources development projects including river, drainage, irrigation, flood mitigation and operation of national hydrological network.
PWD (JKR)	Responsible for public works in water supplies.
JBA	Responsible for the planning and development of water supply for domestic and industrial sector.
DOE	Responsible for the coordination of all activities relating to the discharges of wastes and the prevention and control of pollution.
Local Authority	Responsible for ensuring developments within the municipality area and complying with the conditions set for environmental regulation which includes land clearing.
TNB	Responsible for generation of hydro-electric power and management of electrical installation.
NWRC	Responsible for formulation of National Water Policy, Water Resources Master Plans, determining priority of water use, facilitating more effective water management including the implementation of inter-state water transfer.
Fisheries Department	Responsible for fisheries administration, development of marine and fresh water fisheries and fishing.
MMS	Responsible for weather forecast, hydro-meteorology, and climatologic studies.
Forest Department	Responsible for technical direction and advice on forestry management and development; conservation of forests, assessment utilization and development of forest resources.
Land Department	Responsible for the formulation of land policy, administration of reserve land, administration of private land use and land acquisition.

Source: Keizrul 2002

Traditionally, the management of water resources in Malaysia is largely fragmented and placed under the responsibility of a large number of government departments and agencies, each managing a distinct

component often with little inter-action or co-ordination amongst them. Often, the objectives of each agency (for example the Water Supply Department versus the Tourism Development Board) may be conflicting rather than complementary. Fragmentation has been recognised as a major obstacle to effective management of our water resources (Keizrul 2002). To ensure sustainable development, river basins (from which water resources originate) and other sources of water (such as groundwater, lakes and mining ponds) need to be managed in an integrated and holistic manner. This requires the integration of all government departments and agencies (encompassing the relevant disciplines throughout the whole development cycle, from planning and design through to implementation, operation and management) for effective water resources management. One answer to the above dilemma is to introduce a single agency for the management of water resources via Integrated River Basin Management (IRBM). Ideally, this single agency should not be a federal agency as the limitations of the NWRC has indicated so. Instead, every state should have a single agency to manage water resources. At the federal level, a co-ordinating agency comprising all the state agencies should suffice. Even the current NWRC could perform this co-ordinating and mediating function.

At the state level, Selangor has formed the Lembaga Urusan Air Selangor (LUAS) and Sarawak has the Sarawak Rivers Board (SRB) to manage water resources. This is necessary as the NWRC has limited powers over rivers, water and land (including groundwater) which come under the jurisdiction of the states. Ever since the NWRC was formed, it has not mediated in any inter-state water issues and there has been no co-ordination of development activities between neighbouring states with regards to water. The National Land Council (NLC) (comprised of Federal and State representatives chaired by the Minister) formulates land policies and in this respect can put into practice integrated water resources development and management when the land developed cuts across two states or more. However, as its name implies, the NLC is more concerned about land matters than water matters. Thus far, the NLC has not practiced any integrated water resources development and management.

There are some success stories on water management at the state level. In July 1997 the Cabinet directed the DID to study the possibility of setting up of a single body to manage and regulate rivers, and the Sg. Selangor was suggested as a possible pilot basin. The water crisis of 1998 expedited matters and the Selangor State Government opted to go for a State Authority (Keizrul 2002). Subsequently the "Selangor Waters Management Authority Enactment" or "Enakmen Lembaga Urus Air

Selangor (LUAS)" was passed by the Selangor State Legislative Assembly on 9th April 1999 and LUAS was formed. LUAS is that one-stop agency set up for the regulation, monitoring, planning and conservation of the river and water resources in the state of Selangor. One of the objectives of LUAS is to manage and develop water resources in an integrated manner so that it can achieve a cost-efficient river and water resources management operation and to maintain a sustainable water environment resource for future generations. So far, LUAS appears to be effective and proactive in carrying out its duties. With LUAS, at the very least, we see river basins and water resources being developed and managed in an integrated manner. Another good example of State level water management is that of the SRB in Sarawak. The SRB is not only concerned with water resources but also irrigation, transport, power, recreation and tourism and environmental conservation. Because the SRB manages all rivers (which provides more than 97 % of water supply) in the state of Sarawak, it is able to carry out integrated water resources development and management easily without conflict or competition from other agencies.

On the whole, with the exception of Selangor and Sarawak, integrated water resources development and management is not well developed at the federal level and the remaining states. Even LUAS is pretty new and has encountered problems, especially its maiden venture in building the Selangor Dam and its associated developments. The overall effectiveness of LUAS remains to be seen but at least it has mandatory power and is the sole agency in charge of managing water resources in the state. Ideally, this should be the case in other states as well.

Water Resources Assessment

In Malaysia, much of the work on water resources assessment falls on the shoulders of the Drainage and Irrigation Department (DID), though many individual river basin studies are conducted by private consultants and other international bodies. Malaysia has done a comprehensive national water resources assessment way back in 1982. The study was actually carried out and completed by the Japan International Co-operation Agency (JICA) (JICA 1982). Since then, much development has taken place and much of our water resources depleted, polluted and destroyed. Climate change has also impacted upon our water resources, with less rainfall in many areas due to El Nino (For example in 1997/8 and now in 2002). Water resources assessment must take into account not only land use change due to changes in the "Human Use System" but also changes in the "Natural Events System".

Much of the work in water resources assessment in Malaysia is carried out by the DID, research institutions and universities, private consulting companies (some of which are foreign) and NGOs. The DID has a Hydrology Division that is responsible for water resources management. One of the objectives of the Hydrology Division of DID is "To collect, collate, process, analyse and disseminate hydrological data for studies to evaluate the development and management of water resources" (Source: <http://agrolink.moa.my/ejps.html>). The DID has done a good job as it has developed an accurate hydrological database to support the nation's economic expansion and population growth. DID has amongst its tools an array of sophisticated monitoring and sensing equipment. There is now a vast state and district support network of instrumentation that provide a wealth of hydrological information including rainfall, river levels, streamflow, evaporation and water quality (Source: <http://agrolink.moa.my/ejps.html>). At the DID headquarters, a computerised databank systematically stores and updates the ever increasing volume of data, and provides efficient retrieval of information needed. The Hydrology Division also carries out active research and studies to establish standards and guidelines for hydrological practices which is used by all government departments and agencies as well as the private sector in the proper planning and design of water resource projects for industry, agriculture and human consumption. The efforts of the DID in the area of water data collection and water resources management have earned Malaysia recognition from international agencies such as UNESCO, WMO and ESCAP.

So, on the whole, it can be said that Malaysia's implementation in water resources assessment is good. The only problem is that our national assessment has been done way back in 1982, though a recent water resources study for Peninsular Malaysia has been commissioned. Hence, there is a need to commission another country-wide assessment considering all the rapid development and land use change that has occurred in the last two decades or so.

Protection of Water Resources, Water Quality and Aquatic Ecosystems

Malaysia's commitment towards water resources and aquatic ecosystems protection is highlighted in the 7th and 8th Malaysian Plans as well as in the Department of Environment's objectives (Government of Malaysia 1996; 2001). There are also policies, laws, regulations and EIA requirements in developments which can have an effect on water resources (Jamaluddin 1997). However, Malaysia has experienced rapid economic growth in the last three decades and this has brought about unprecedented land use

changes on a scale never witnessed before. Consequently, large tracts of forests, ranging from highland montane forests to lowland rainforests and coastal cum riverine floodplains, all water catchments, have made way for human land use. Forests and wetlands not only capture rainwater and retain it, but also ensure good water quality by its natural filtration systems. They also control floods by intercepting rainfall at the canopy and regulating the flow of rain down branches, trunks and roots before reaching the river. However, rapid development in Malaysia has systematically destroyed and decimated forests and wetlands (including the lakes which they surround). This has manifested itself in an ugly way as water sources are depleted and floods exert a heavy toll on the environment and human populations. Some of the more severe flood in recent decades have been linked by scientists to the replacement of forests with agriculture, industrial, urban and other forms of human land use which are incompatible with the environment. Pollution of rivers is also getting worse as more and more rivers fall under the polluted category (Chan 2002b) (Table 2).

Almost all urban areas have experienced expansion with rapid build up of commercial and housing areas. In rural areas expansion of plantation agriculture has depleted large areas of natural jungle. Mining operation, housing and road development, logging and clearing of forest are major causes of high concentration of suspended sediment in downstream stretches of rivers. The lower stretches of our rivers are characterised by heavy silt loads especially after heavy rains (Douglas 2002). In urban areas, this is the direct consequence of large numbers of land clearings for projects such as housing, industry and highways and the subsequent strong erosion caused by heavy rains. Studies have shown that in urban areas 90 % of sediment load to rivers come from land cleared for construction. One consequence of these changes is a tremendous strain on our natural waterways, and excessive silt loadings on the river systems. Agriculture Minister Datuk Mohd Effendi Norwawi said that "River care could have saved at least RM4 billion each year" as this was the amount of money spent to widen, deepen, reduce flooding and clean up all the rivers in the country (The Star 2000). The government spends about RM7 million cleaning up garbage from rivers alone each year. This shows that the government is doing something about protection and restoration of rivers, but it is not enough as only a few major rivers are been cleaned and the rest remains as dirty as ever. Moreover, too many agencies have an interest in rivers resulting in competition and conflicting uses (Chan 2002b). Malaysia has not carried out identification of potential water supply such as groundwater, examining ponds, lakes and other sources other than looking to rivers for

water. There are no national plans specifically for water supply, though many states have prepared state plans for water-supply.

Table 2. Quality of river waters, 1987 – 1997

Year	No. of Rivers Monitored	Clean	Slightly polluted	Very polluted
1987	91	43	45	3
1988	91	48	40	3
1989	91	45	43	3
1990	90	48	35	7
1991	87	37	44	6
1992	87	25	55	7
1993	116	30	75	11
1994	116	38	64	14
1995	115	48	53	14
1996	116	42	61	13
1997	117	24	68	25
1998	117	33	68	13
2002	120	30	68	22

Source: Department of Environment, Malaysia

There are adequate laws to control water pollution in Malaysia but as always, enforcement is not stringent or comprehensive enough. Hence, the number of reported water pollution cases has increased many folds over the years and the number of culprits charged and fined is small (Chan 2002a). The “Polluter Pays” principle does not appear to work well because fines are small and polluters get off easily. The federal and state governments have also tried gazetted water catchments but the area gazetted is small in relation to the area needed for sustainable management of water catchments. Many water catchment land is actually privately owned and developed for various purposes. Government is only beginning to control water pollution via development and application of clean technology such as effluent control and emission control. Much needs to be done in this area. Groundwater is not well protected and many industries draw groundwater without the need for a permit.

Drinking-Water Supply and Sanitation

Currently, about 98% of the urban population and 87% of the rural population are served with piped water (The Malaysian Water Association 2002:8). Hence, Malaysia’s drinking water supply coverage is as good as any developed country. Furthermore, all the major

industrial areas in the country are supplied with good water supply in terms of pressure and quality. Capital investment (public and private) is increasing over each Malaysia Plan. In the Eighth Malaysia Plan, this adds up to RM7 billion. Despite such encouraging figures, water stress and water cuts continue to plague many parts of the country, notably the high density areas in cities where demand is great. Changing weather patterns, high non-revenue water, high wastage, pollution and sedimentation, and a host of other problems have also seriously depleted water resources. This has caused severe water shortages in recent years, notably during the El Nino in 1997/98 and in early 2002 (Chan 2000, 2002a). In relation to water supply from rivers (which contribute more than 97 % of total water supply in Malaysia), river management has serious limitations because of the lack of a single national body. With the exception of Selangor (which has a body called Lembaga Urusan Air Selangor) and Sarawak (which has the Sarawak Rivers Board), the DID is largely responsible for managing rivers in the country. Rivers are the natural lifelines which provide the bulk of our water supply, but mismanagement of our rivers is gradually turning our rivers into open sewers and polluting this main source of our water supply. Upstream uncontrolled development give rise to destruction of water catchments, severe soil erosion, landslides, and ultimate siltation and sedimentation of rivers downstream (Chan & Wan Ruslan 1997). This not only depletes our water resources and render water catchments unable to store water, but also causes more severe and more frequent flooding (Chan 1995). Therefore, it is imperative that rivers be looked after. There can be no effective water resources management without effective river management.

With an average annual rainfall of 3,000 mm, Malaysia has abundant water resources, i.e. endowed with about 566 billion m³ of surface water per annum (run off in river systems). However, due to reasons mentioned above and the variation of rainfall amount over time and space, there is great variation which often leads to drought and at other times to floods. Water demand in Malaysia is estimated at growing at the rate of 4 % per annum. This is projected to be about 20 billion m³. Even now, 25 river basins have been identified as areas experiencing water stress (Keizrul 2002). More and more, these areas will come under water stress. The Malaysian Government has realized the importance of protecting rivers in recent years and have allocated funds for restoration of some of the major rivers in the country while some foreign based donors have been actively funding the restoration of a few rivers for some time now. Unfortunately, however, only a few rivers have been given attention to while the rest continue to be degraded and polluted.

About 20 tonnes of rubbish are dumped into the rivers in Kuala Lumpur alone (The Sun 2002). In 1999, Penang Island recorded about 1,000 tonnes every 3 months collected from drains and rivers (The Star 1999). Table 2 illustrates the extent to which our rivers have deteriorated over the years.

Water crises in 1991, 1997/98 and 2002 highlight that there is much to be done, as the general consensus is that not enough has been done to address water woes. The water authorities continue to employ a largely single approach of supply management and have neglected demand management and other water management tools. Hence, many states are on the brink of a water disaster (lack of water) in the next few decades (Global Environment Centre 1999). Many water-poor states are already planning to transfer water from other water-rich states. However, much remains to be done by the Malaysian authorities before this can work.

Sanitation and sewerage has been a real problem for Malaysia ever since the service was privatized. The company awarded the contract probably tried its best but lack of resources, inadequate experience, the public's unwillingness to pay and other reasons led to its collapse. The privatization of sewage treatment has also been ineffective as the company awarded the contract has made huge losses and had to be bought back by the government. The seriousness of this problem is proven by the fact that only less than 17 % of the more than 5,409 treatment plants run by IWK comply with the discharge standards detailed in the Environmental Quality (Sewage and Industrial Effluent) Regulations, 1979 of the DOE (The Star 1999). In the meantime, the increasing population adds to the problem. Furthermore, squatter colonies that have mushroomed all over cities in the country (many on hazardous river banks) do not have proper facilities, including sanitation and piped water, and the squatters discharge their wastes into the rivers directly using the rivers as open sewers. In older housing areas, there are no central sewerage treatment facilities though some have septic tanks. Shop-houses built decades ago in the older parts of many cities such as Georgetown, Kuala Lumpur, Ipoh and Johor Bahru do not have proper sanitation and discharge their grey-water straight into drains which eventually end up in rivers. Sanitation and sewerage treatment is one area that the authorities have much to do. This issue is all the more important because of the disastrous effect untreated wastes water have on receiving waters which we depend on for water supply.

Water and Sustainable Urban Development

There is no development without water. However, ironically, development has depleted and polluted water, the very life that it

depends upon. Urbanisation and other urban developments have replaced forests with “concrete forests” comprising impermeable land surfaces and this has caused severe soil erosion, sedimentation and pollution (total solids). Rapid urban development in Malaysia since independence has transformed the country from a once largely rural-agrarian economy to a booming industrial-commercial economy which is based on a rapidly expanding urban population. The rate of urbanization has increased tremendously from 10.7 % in 1911 to 62.0 % in 2000 (Table 3). By 2020 when Malaysia achieves the developed nation status, the rate of urbanization is expected to exceed 65 %. Urbanisation is a continuous process that is difficult to stop. In fact, government policies encouraging industrialization and the service industry are indirectly fostering urbanization. More and more rural folks are migrating to urban areas to look for work and riches. In addition, migrants (both legal and illegal) from neighbouring countries are coming into the country to look for a better life. It is estimated that there may be about 3 million foreigners in the country, most of them in urban areas.

Table 3. Increasing rate of urbanization in Malaysia, 1911 to 2000

Year	Total Population	Percentage Urban	Number of Urban Centres
1911	2,339,000	10.7	8
1921	2,907,000	14.0	14
1931	3,788,000	15.1	16
1947	4,908,000	15.9	20
1957	6,279,000	26.6	36
1970	8,810,000	28.7	49
1980	11,473,000	37.5	68
1985	12,968,000	41.1	NA
1990	14,605,000	44.7	129
1995	20,689,300	54.7	129+
2000	23,263,600	62.0	129+

NA = Not Available

Source: Ooi 1979; Government of Malaysia 1996

Essentially, studies have shown that cities and urban development are neither sustainable nor environmentally friendly. Megacities, cities, towns and other built-up areas rely on their hinterland for most of their resources, including water (Chan et al. 1999). In addition, expansion of urban areas and encroachment of urban areas into flood plains, hill slopes, forest and agriculture land have put tremendous stress on water

resources as a result of increasing demands and dwindling water sources. For example, flood hazards and water crises frequently occur in Kuala Lumpur, Georgetown and other urbanized areas as a result of an unhealthy combination of expanding human demands and destruction of nature. In terms of the government's efforts at controlling urban development, not much has been done (in fact the government either directly or indirectly encourages urbanization) and nothing much can be done about rural-urban migration and transmigration (aliens).

Chan (2002a) has demonstrated that urbanization has increased the incidence of water hazards in Malaysia, particularly floods. Though river conservancy has been a traditional function of the DID since its inception in 1932, it was only after the nationwide flood in 1971, that the DID was entrusted to undertake an extensive flood mitigation programme. Unfortunately, again the DID's approach to flood management is based on a structural approach hinging on the use of large structures to control floods. Hence, over the years since independence, there has been large financial support from the Federal Government pouring in to build multi-purpose dams and many major rivers that run through major cities have been canalized. Other structural measures include river diversion, river training and clearing, as well as the year-round deepening and widening of rivers. In major cities, urban drainage was improved ostensibly to alleviate flooding but this has been a lost battle as the DID has recently indirectly admitted that drains actually make flooding worse as large volumes of water are channeled into rivers in a very short time, resulting in flash floods, now a normal sight in the major cities of Kuala Lumpur, Georgetown and Kota Bharu. The DID has now come up with a manual that promotes "Environmentally Friendly Drainage By Controlling Runoff At Source". Instead of channeling rains and water into drains, the excess water is allowed to seep into underground drainage that retains the water that then seeps slowly into the river. However, contractors and developers are skeptical and slow to adopt the new method because it is not mandatory. If the DID is convinced that the new manual works, which I think it will, then it should push for the manual to be made mandatory.

Water for Agriculture and Rural Development

Though Malaysia has moved from an agrarian economy in the 1960s to a largely manufacturing economy now, agriculture remains important for strategic reasons. Not surprisingly, agriculture is the largest water user in Malaysia, taking up about 67 % or 10.4 billion cubic metres (BCM) of water per annum. Unfortunately, despite so much water used, irrigation efficiency in Malaysia is at best about only 50 % in the larger irrigation

schemes and less than 40 % in the smaller ones (Shahrizailla 1999). Such high rates of water loss are certainly not sustainable by any means. Noting that the irrigation sector is currently the main consumer of water while the water demand from the domestic and industrial sectors are increasing at a fast rate, the government (through the DID) has taken positive steps to address the issue. As the amount of water is finite, water will ultimately be a limiting resource for the expansion of food production. Hence, apart from improving irrigation efficiency, there is a need to concentrate on efforts to save water through better agricultural practices (such as drip-irrigation and planting of dry padi), recycling of drainage water from padi fields, better rain harvesting, groundwater usage, use of unconventional water and others. To this end, the Malaysian government (through the DID's irrigation programme) has aimed at increasing paddy production through many activities. However, agriculture is becoming less and less attractive to the younger generation who are now more educated than their forefathers and want more lucrative jobs. As a result, there is the problem of abandoned land. This is one issue that is not resolved. Rural-urban migration has also drained the rural areas of labour and this is hampering rural development, though water is adequate in rural areas which are not totally dependent on piped water supply, but also rainwater, well water, river water and other water bodies.

Impacts of Climate Change on Water Resources

Global climate change is one of the major concerns at Rio in 1992, in Kyoto in 1997 and again in Johannesburg in 2002. All the scientific facts point to an increase in global temperatures that is magnifying water hazards all over the world. In Malaysia, global climate change has manifested itself largely in terms of El Nino and La Nina. In recent years, rainfall patterns are changing due largely to regional and global weather and climate shifts. For example, the El Nino of 1997/98 and La Nina of 1998/99 are vagaries of the climate that have affected the water resource situation in Malaysia. The 1997/98 El Nino peaked around April 1998 exposing many states' fragile water security situation. This has given rise to a water crisis which afflicted many parts of Selangor, Kuala Lumpur, Malacca, Sabah, Sarawak and Penang (Chan 1998). In 2002, again an impending El Nino has caused water stress in Malacca, Selangor and Perlis. The 1997/98 El Nino caused extensive losses in Southeast Asia alone. The Environment and Economy Programme of Southeast Asia and the World Wide Fund for Nature estimated that losses due to the Indonesian fires and the resulting haze which blanketed the region in 1997 amounted to RM17.1 b (US\$4.5 b). The fires and haze also affected 5 million hectares of forests and 70

million people (Asiaweek 1998). The estimates are conservative and include lost resources, short-term health costs and lost tourist revenues. It does not include lost of life and biodiversity, long-term health effects and reduced farm productivity.

Hence, both the El Nino and La Nina episodes laid bare the fact that Malaysia is extremely susceptible to water stress, be it in excess or deficit. The water authorities must take swift action to include climate change such as El Nino and La Nina into their water resource planning. So far, they have not done so and dams have run low and water crises occurred because of that. Instead, many states have tried to address the problem by building more dams to increase water supply (i.e. sticking to the outdated "Supply Management Approach") and at inter-State water transfers. Malaysia must increasingly explore the advantages of Demand Management (reducing demand and wastage) as a complementary approach to supply management to solve its water problems.

SHORTCOMINGS AND OBSTACLES

Despite some progress in water resources management, there remains many shortcomings and obstacles to more effective and sustainable water resources management in Malaysia. One is the absence of a clear-cut National Water Resources Policy to guide the sustainable development of water resources and water sector strategies. Currently, there are too many agencies and government departments (both at the federal and state levels) involved in water resources, some directly and some and no central agency specifically set up to manage and arbitrate in inter-state water disputes at the state level where it is most vital (The National Water Resources Council (NWRC) is less than effective at the moment). States are suspicious of the role of the NWRC (a federal body) and are afraid that the NWRC will undermine or erode their hold over their water resources. There are no costed and targeted national action water plans and investment programmes. Presently, only some river basin plans are costed.

In terms of legislation, there are sufficient laws for the integration of measures for the protection and conservation of potential sources of freshwater supply, but poor enforcement is a major obstacle for implementation. Nevertheless, there is no single water law or river law to specifically protect water resources. The EIA is also subject to exploitation as there are many loopholes, viz. the 50 ha limit; EIA that does not cover effects on adjacent areas outside the development proposal; Poor enforcement of EIA requirements; etc. All these limits implementation. Another major obstacle is that the majority of water

authorities use demand management sparingly and probably has little expertise within their organizations to tackle this issue. Protection of water resources, water quality and aquatic ecosystems against deforestation, destruction of catchments, pollution and other negative impacts is not comprehensive.

Water pricing can be an effective tool to curb water wasting. However, a major obstacle is that it is a politically sensitive issue. The general consensus is that water tariffs in Malaysia are very low compared to other countries and this is a major obstacle when trying to convince the public to conserve water and industry to install costly recycling plants. The Malaysian Privatisation Program – Like many utilities, the government is trying to privatized the water industry. This may not necessarily be bad as privatization has proven successful in many developed countries. However, the main obstacles to privatization are perhaps the lack of meritocracy, transparency, accountability and profitability.

Malaysia has hitherto refrained from developing new and alternative sources of water-supply such as sea-water desalination, artificial groundwater recharge, use of marginal-quality water, waste-water reuse and water recycling. One major obstacle to effective water management is that policy makers are still having the old mindset (a misconception) of Malaysia being a country blessed with heavy rainfall. They must now realize that population growth, pollution, destruction of catchments, and changing climate have significantly reduced our total available water. There is little promotion of water conservation through improved water-use efficiency and wastage minimization schemes for all users, including the development of water-saving devices. Furthermore, ISO14000 certification is not made mandatory for large water users such as industries and hotels.

Public participation in water resources management is poor, largely due to reluctance of the water authorities to use the public and also public apathy. Decision-making in water resources planning and management is still largely a Top-Down approach. There are huge gaps for the promotion of schemes for rational water use through public awareness-raising and educational programmes as most of the work now is done by NGOs. There are only some public awareness work carried out by the authorities (e.g. DID's "Love Our River Campaign"). There has been no national-wide water conservation campaign. Consequently, there is little integration of cooperation at all levels from government to water company to industry to NGO and to the public – an obstacle to implementation.

Sanitation and sewerage treatment pose a major obstacle, viz. how to convince the public that it should pay for the service. Unless the public pays, it is unlikely that this service will be effective. Government cannot buy back privatized companies whenever they come under receivership or suffer losses. Water pollution remains a major obstacle as the big question is “How to clean up all the polluted rivers and ensure ensure the clean ones are not polluted?” This leads us to the problem of treating rivers as open sewers, a major obstacle faced by implementing agencies for river conservation and water resources protection. Unless this unhealthy habit is changed, rivers and their waters will continue to suffer. Squatter colonies pose another major obstacle to clean up rivers and protect water resources. Rapid unplanned urban development that replace forests with impermeable land surfaces cause severe soil erosion, sedimentation and pollution (total solids) that lead to flooding and excessive water demands that supply cannot keep up with. Related to this is rural-urban and transmigration, two major obstacles. Irrigation remains a big obstacle that the government has to address as it uses 67% of total water supply. Climate change (causing droughts at times and flood at other times) is another obstacle confronting water authorities.

The DID, recognized as the water resources and flood management authority, has no mandatory power, only advisory power. Instead development plans are approved by other government agencies who probably has little knowledge about water resources and flood management. This remains a major obstacle for greater effectiveness in water resources and flood management in the country. The DID, Water authorities, state governments and local governments largely employ the structural (engineering) approach to address water resources and flood issues. This limits the overall effectiveness as there are a multitude of non-structural measures that can be used. The above government bodies do not practise a multi-disciplinary approach.

Finally, principles of rainfall harvesting, use of wells and traditional water systems have not been popularized. For example, the time has come for local authorities to make building/house designs mandatory with rainfall harvesting mechanisms or at least give discounts of owners opt for such designs. Recycling of water is another area that needs greater focus and emphasis. The Malaysian Government has in recent years gone on a campaign to recycle many items (such as plastics, aluminium cans, bottles, glass, metals, paper, etc). However, there is a gap here as water recycling has hitherto not been focused upon.

CONCLUSIONS AND RECOMMENDATIONS

Malaysia has made some progress towards safeguarding and developing water resources in a sustainable manner. The government is committed on promoting sustainable development and environmental protection as inseparable from water resources. After all the water problems encountered, the government is aware that there can be no development without water, and that the country's rich water resources must be protected and managed carefully as it can mean the progress or collapse of society. Hence, there is an urgent need to formulate a clear-cut National Water Resources Policy to guide the sustainable development of water resources and water sector strategies. Costed and targeted national action water plans and investment programmes need to be carried out. Specifically, a new national water resources assessment needs to be commissioned to ascertain what is the current water resources situation. To overcome the problem of too many agencies and government departments (both at the federal and state levels) involved in water resources, a central agency for water management needs to be set up at each state where it is most vital. The National Water Resources Council (NWRC) can remain as the co-ordinating body at the federal level.

There is a need to pass a water law and a river law to specifically protect water resources. Enforcement also needs to be stepped up. DOE staffing needs to be strengthened, as are monitoring staff of local authorities. In this respect, some of the DOE functions on enforcement can be farmed out to local municipalities, the police, the army or town and district councils. The EIA also needs to be revamped to pluck all the present loopholes. Demand management needs to be made an integral aspect of overall water management by all water authorities. To implement this effectively, they should work closely with NGOs who have the expertise.

Pricing needs to be used as a tool to curb water wasting. However, it should not be priced beyond the reach of the poor as water is an essential resource. As for industrial and commercial tariffs, government should pitched it so that it would make installation of water recycling plants cost-competitive vis-à-vis the new water tariffs.

A year-round nation-wide water conservation campaign needs to be aired on TV, Radio and the mass media, not just piece-meal "once in a blue moon" events. Examine and look into the prospects of developing new and alternative sources of water-supply such as groundwater, use of marginal-quality water, waste-water reuse and water recycling. There should be a mandatory ISO14000 requirement for large water users. In this respect, tax-exemption/reduction should be given to companies that

recycle. Public participation in water resources management should be made mandatory for all development projects involving water. The solely Top-Down approach is counter productive and unacceptable if Malaysia wants to call itself a democratic country. In this respect, government needs to make use of NGOs and involve them at all levels of development as NGOs form the link between government and people. No project can be completely successful without public support.

There is an urgent need to gazette water catchments for the protection of water resources, water quality and aquatic ecosystems against further deterioration. Privatization of water supply, sanitation and sewerage treatment needs to be carried out based on transparency, meritocracy and accountability. Government should always maintain a hold or share in the privatized water companies, like in the case of the Penang Water Supply Corporation Sdn Bhd. All river restoration programmes should be expedited. The Squatter issue, especially squatter colonies adjacent to river banks, must be addressed. Malaysia should also explore alternative forms of irrigation that recycle water, use less water and are sustainable. Related to food production is to plant drought resistant crops, practise conservative farming techniques, pest-resistant crops, etc. Climate change (causing droughts at times and flood at other times) is affecting our water resources and floods, and must be studied and incorporated into development planning.

The DID, by virtue of being the water management expert, should be given some degree of mandatory power when it comes to dealing with water resources and flood mitigation. If necessary, the DID, Water authorities, local governments and other approving bodies should be revamped so that their staff comprise expertise from a wide range of disciplines. The staff should not be experts in only one area, viz. engineering as this would foster the structural approach. For all water resources and flood management, a comprehensive structural cum non-structural approach (each given equal emphasis) should be employed. Finally, rainfall harvesting should be made mandatory for new building/house designs, or at least those that come with such designs be given tax-exemption or other incentives.

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REFERENCES

- Amery, H.A. & Wolf, A.T. 2000 *Water in the Middle East – a geography of peace*. Austin: University of Texas Press.
- Asiaweek. 1998. 12 Jun.
- Cech, T.V. 2002. *Principles of water resources: history, development, management and policy*. New York: John Wiley & Sons, Inc.
- Chan, N.W. 1995. A Contextual analysis of flood hazard management in Peninsular Malaysia. Flood Hazard Research Centre Publication No. 267, Enfield (UK).
- Chan, N.W. (ed.). 1997. *Proceedings of the international conference Meeting Water Challenges in the 21st Century*. Water Mobilising Programme of the Alliance for a Responsible and United World, Paris, 193 pp.
- Chan, N.W. 1998. The current water crisis: what went wrong? *Aliran Monthly*, 18(5): 14-18.
- Chan, N.W. 2000. El Nino and the 1998 water crisis in Malaysia: causes, lessons and solutions. In. Kowalski, K.M. & Trevits, M.A. (eds.). *Contingencies, emergency, crisis, and disaster management: emergency management in the third millennium*: 32-41. Pittsburg: The International Emergency Management Society (TIEMS).
- Chan, N.W. 2002a. *Pembangunan, pemandaran dan peningkatan bencana air di Malaysia: isu, pengurusan dan cabaran*. Siri Syarahan Umum Pelantikan Profesor, Pelantikan 2001/Bil. 1, Penang: Penerbit Universiti Sains Malaysia.
- Chan, N.W. (ed.). 2002b. *Rivers: towards sustainable development*. Penang: Penerbit Universiti Sains Malaysia.
- Chan, N.W., Morshidi Sirat, Ruslan Rainis, Wan Ruslan Ismail & Ab Latif Ibrahim. 1999. Urban sustainability and the effects of rapid socio-economic, industrial and infrastructure development in Penang Island. *Monograph Series on Environment and Development*: 415-527. Kuala Lumpur: Institute of Strategic and International Studies (ISIS) Malaysia.
- Chan, N.W. & Wan Ruslan Ismail. 1997. Impak manusia terhadap unsur-unsur kitaran hidrologi di Malaysia. *Ilmu Alam*, 23: 41-58.
- Clark, R. 1991. *Water: the international crisis*. London: Earthscan Publications Ltd.
- Douglas, I. 2002. Sediment: a major river management issue. In. Chan, N.W. (eds.). *Rivers: towards sustainable development*:15-24. Penang: Penerbit Universiti Sains Malaysia.
- <http://agrolink.moa.my/did/rivers/stormwater>
- <http://agrolink.moa.my/ejps.html>
- Global Environment Centre. 1999. *Sustainable management of water resources in Malaysia*. Petaling Jaya: Global Environment Centre.
- Government of Malaysia. 1996. *7th Malaysia Plan 1996-2000*. Kuala Lumpur: Government of Malaysia.
- Government of Malaysia. 2001. *8th Malaysia Plan 2001-2005*. Kuala Lumpur: Government of Malaysia.

- Jamaluddin Md. Jahi. 1997. Perundangan dan pengurusan alam sekitar oleh pihak berkuasa tempatan di Semenanjung Malaysia. In Rokiah Hj Ismail, Samsudin Abdul Rahim, Faridah Ibrahim, Zaidah Mustapha & Saedah A Ghani (eds.). *Isu sosial dan komunikasi*: 93-105. Bangi: Geography Department, Universiti Kebangsaan Malaysia.
- JICA. 1982. *National water resources study, Malaysia*. Kuala Lumpur: Japan International Cooperation Agency.
- Keizrul bin Abdullah. 2002. Integrated river basin management. In. Chan, N.W. (eds.). *Rivers: towards sustainable development*: 3-14. Penang: Penerbit Universiti Sains Malaysia.
- Montaigne, F. 2002. Water pressure. *National Geographic*, September: 2-33.
- Ooi, J.B. 1979. *Semenanjung Malaysia*. Kuala Lumpur: Longmans.
- Renganathan, M. 2000. Taking care of water, the responsibility of all. Paper presented at the National Seminar Environmental Management Plan for the Proposed Beris Dam Project in Kedah Darul Aman, Sungei Petani, Kedah. 28 February- 1st march
- Shahrizailla Abdullah. 1999. Towards a Malaysian and global vision for water, life and the environment. In. *Sustainable Management of Water Resources in Malaysia*:17-24. Petaling Jaya: Global Environment Centre.
- The Malaysian Water Association. 2002. *Malaysia water industry guide 2002*. Kuala Lumpur: The Malaysian Water Association.
- The Star. 1999. 22 August.
- The Star. 1999. 23 December.
- The Star. 2000. 11 February.
- The Star. 2002. 5 September.
- The Sun. 2002. 29 March.

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